Draft decision

TransGrid transmission determination

2015–16 to 2017–18

Attachment 6: Capital expenditure

November 2014

AUSTRALIAN ENERGY REGULATOR

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Note

This attachment forms part of the AER's draft decision on TransGrid's revenue proposal 2015–18. It should be read with other parts of the draft decision.

The draft decision includes the following documents:

Overview

Attachment 1 – maximum allowed revenue

Attachment 2 – regulatory asset base

Attachment 3 – rate of return

Attachment 4 – value of imputation credits

Attachment 5 – regulatory depreciation

Attachment 6 – capital expenditure

Attachment 7 – operating expenditure

Attachment 8 – corporate income tax

Attachment 9 – efficiency benefit sharing scheme

Attachment 10 – capital expenditure sharing scheme

Attachment 11 – service target performance incentive scheme

Attachment 12 – pricing methodology

Attachment 13 – pass through events

Attachment 14 – negotiated services

Contents

Shortened forms

Shortened form	Extended form
AARR	aggregate annual revenue requirement
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ASRR	aggregate service revenue requirement
augex	augmentation expenditure
capex	capital expenditure
CCP	Consumer Challenge Panel
CESS	capital expenditure sharing scheme
CPI	consumer price index
DRP	debt risk premium
EBSS	efficiency benefit sharing scheme
ERP	equity risk premium
MAR	maximum allowed revenue
MRP	market risk premium
NEL	national electricity law
NEM	national electricity market
NEO	national electricity objective
NER	national electricity rules
NSP	network service provider
NTSC	negotiated transmission service criteria

Shortened form	Extended form
opex	operating expenditure
PPI	partial performance indicators
PTRM	post-tax revenue model
RAB	regulatory asset base
RBA	Reserve Bank of Australia
repex	replacement expenditure
RFM	roll forward model
RIN	regulatory information notice
RPP	revenue pricing principles
SLCAPM	Sharpe-Lintner capital asset pricing model
STPIS	service target performance incentive scheme
TNSP	transmission network service provider
TUoS	transmission use of system
WACC	weighted average cost of capital

6 Capital expenditure

Capital expenditure (capex) refers to the capital expenses incurred in the provision of prescribed transmission services. The return on and of forecast capex are two of the building blocks that form part of TransGrid's total revenue requirement.[1]

We generally categorise capex as either network or non-network capex. Network capex includes growth-driven capex and non-load driven capex. Growth-driven capex includes augmentations and new connections. Non-load driven capex includes replacement and refurbishment capex. Non-network capex covers expenditure in areas other than the network and includes business information technology (IT) and buildings/facilities.

This attachment sets out our draft decision on TransGrid's proposed total forecast capex. Further detailed analysis is in the following appendices:

- Appendix A - capex associated with each of the capex drivers that underlie TransGrid's proposed total forecast capex
- Appendix B - overview of our assessment approaches
- Appendix C - demand
- Appendix D - real cost escalation
- Appendix E - contingent projects.

6.1 Draft decision

We are not satisfied that TransGrid's proposed total forecast capex of $1,387.4 million ($2013–14) for the 2014–2018 period reasonably reflects the capex criteria. Our alternative estimate of TransGrid's total forecast capex for the 2014–2018 period that we are satisfied reasonably reflects the capex criteria is $922.34 million ($2013–14). Table 6-1 outlines our draft decision.

Table 6-1 Our draft decision on TransGrid's total forecast capex (million $2013–14)

	2014–15	2015–16	2016–17	2017–18	Total
TransGrid's proposal	353.5	400.9	311.0	322.0	1,387.4
AER draft decision	240.8	239.4	223.0	219.1	922.3
Difference	112.7	161.5	88.0	102.9	465.1
Percentage difference (%)	32	40	28	32	34

Source: TransGrid, *Revenue Proposal,* May 2014, p. 70; AER analysis
Note: Numbers may not total due to rounding.

[1] NER, cl. 6A.6.4(a).

A summary of our reasons and findings that we present in this attachment and appendix A are set out in Table 6-2. It is important to recognise that our decision is about TransGrid's total forecast capex for the 2014–2018 period. We are not approving a particular category of capex or a particular project, but rather an overall amount. However, as part of our assessment, we necessarily review the categories of expenditure and some particular projects in order to test whether TransGrid's proposed total forecast capex reasonably reflects the capex criteria. This is explained further in our assessment approach at appendix B. It follows that our findings and reasons on the capex associated with specific capex drivers, as set out below and in appendix A, are part of our broader analysis and are not intended to be considered in isolation.

Table 6-2 Summary of AER reasons and findings

Issue	Reasons and findings
Forecasting methodology, key assumptions and past capex performance	Our concerns with TransGrid's forecasting methodology and key assumptions are material to our view that we are not satisfied that its proposed total forecast capex reasonably reflects the capex criteria. In particular: ▪ TransGrid's forecasting methodology applies a bottom-up assessment but not a top-down assessment. We consider a top down assessment critical in deriving a total forecast capex allowance that reasonably reflects the capex criteria. We also find that TransGrid's forecasting methodology incorporates an overly conservative risk assessment which does not adequately justify the timing and priority of its proposed forecast capex. ▪ We have concerns with how TransGrid has formulated and applied its key assumptions in relation to demand and forecast materials escalation rates and labour escalation rates. We also observe that TransGrid's past capex performance reveals that its capital efficiency has been declining over time and is lower than that achieved by a number of other transmission networks. This suggests that efficient reductions in capex are achievable. This observation provides context for our analysis of specific capex drivers in Appendix A. In determining our alternative estimate we have addressed the concerns we have with TransGrid's forecasting methodology and key assumptions. Specifically, we have undertaken a top-down assessment by applying our assessment techniques of economic benchmarking, trend analysis and an engineering review. We have also addressed the deficiencies in TransGrid's key assumptions about demand forecasts and forecast materials escalation rates and labour escalation rates.
Augmentation capex (augex)	We have accepted and included TransGrid's proposed forecast augex of $65.1 million ($2013–14) in our alternative estimate. TransGrid's proposed augex aligns with the low levels of demand growth forecast over the 2014–2018 period and is consistent with AEMO's assessment which confirms a network need for TransGrid's two key augex projects.
Customer connections capex	We have accepted and included TransGrid's proposed forecast connections capex of $6.98 million ($2013–14) in our alternative estimate. We have found that TransGrid's proposed forecast connections capex reflects the trend of reduced demand and capacity constraints of the NSW distribution networks since the start of the 2009–2014 regulatory control period.
Replacement capex (including security and compliance capex)	We have not accepted TransGrid's proposed forecast repex of $925.2 million ($2013–14) and its proposed forecast of security and compliance capex of $129.6 million ($2013–14). On the basis of the information before us, these amounts are overstated and exceed the amount required to achieve the capex objectives. TransGrid's proposal is also a significant step increase from the 2009–2014 regulatory control period which is not supported by the capex performance metrics or any asset health and risk level analysis.

Issue	Reasons and findings
	We have instead included an amount of $693.8 million ($2013–14) of forecast repex (including $46.1 million for security and compliance capex) in our alternative estimate that we are satisfied reasonably reflects the capex criteria. This amount will allow TransGrid to achieve the capex objectives. In particular, this amount is: ▪ 30 per cent less than TransGrid's proposal for repex, which is the extent to which we consider TransGrid's proposal is overstated and not required to achieve the capex criteria. We have made this reduction on the basis of our acceptance of EMCa's analysis that TransGrid's proposal is likely to be overstated in the order of 20 to 30 per cent and the concerns we identified with TransGrid's forecasting methodology. In our view, TransGrid's forecasting methodology, which relies principally on a bottom-up assessment and does not demonstrate how TransGrid has considered the proposed repex for the 2014–2018 period in the context of any strategic longer term planning, is likely to over-estimate individual project risks and to overstate the repex required during the 2014–2018 period. ▪ 85 per cent less than TransGrid's proposal in relation to its security and compliance related expenditure, which is the extent to which we consider it is overstated and not required to achieve the capex criteria. This 85 per cent reduction reflects the systemic overestimation of risk in relation to its low transmission line spans. ▪ 30 per cent less for the remainder of TransGrid's proposed security and compliance capex, consistent with our views on TransGrid's proposed forecast repex.
Strategic property acquisitions capex	We have not accepted TransGrid's proposed forecast capex of $114.7 million ($2013–14) for strategic property acquisitions. This amount is overstated and exceeds the amount required to achieve the capex objectives. We have found that TransGrid has not accurately forecast the costs or, on the basis of the information before us, demonstrated the need for all of the proposed property acquisitions. We have instead included an amount of $10.9 million ($2013–14) of forecast strategic property acquisitions capex in our substitute estimate that we are satisfied reasonably reflects the capex criteria. This amount will allow TransGrid to achieve the capex objectives. In particular, this amount: ▪ excludes forecast capex for five strategic property acquisitions where TransGrid has not accurately forecast the costs or demonstrated the need for the acquisition in the 2014-18 period ▪ allows for the strategic acquisition of easements for existing lines in the ACT and a site for a future substation near Beryl.
Non-network capex	We have accepted and included TransGrid's proposed forecast non-network capex of $145.7 million ($2013–14) in our alternative estimate. We find that on average, TransGrid's forecast non-network capex is 23 per cent lower per year than actual non-network capex it spent during the 2009–2014 regulatory control period. We also find that the longer term trends in non-network capex suggests that TransGrid has forecast capex returning to levels consistent with historical expenditure in this category.
Real cost escalators	We have not accepted TransGrid's proposed real escalation of commodity prices. We also have not accepted TransGrid's proposed real escalation of labour prices. Our reasons for this are: ▪ The degree of the potential inaccuracy of commodities forecasts due to: ▪ recent studies which show that forecasts for example of crude oil spot prices based on futures prices do not provide a significant improvement compared to a 'no-

Issue	Reasons and findings
	change' forecast for most forecast horizons, and sometimes perform worse ▪ evidence in the economic literature on the usefulness of commodities futures prices in forecasting spot prices is somewhat mixed. Only for some commodities and for some forecast horizons do futures prices perform better than 'no change' forecasts; and ▪ the difficulty in forecasting nominal exchange rates (used to convert most materials which are priced in $USD to $AUD). A review of the economic literature of exchange rate forecast models suggests a "no change" forecasting approach may be preferable to the forward exchange rate produced by these forecasting models. ▪ The limited evidence available to us neither supports or confirms how accurately TransGrid's commodities escalation forecasts are likely to reasonably reflect changes in prices paid by TransGrid for physical assets in the past. Therefore, it is not open to us to conclude that TransGrid's forecasts are reliable and accurate. ▪ TransGrid has not provided any supporting evidence to show that it has considered whether there may be some material exogenous factors that impact on the cost of physical inputs that may affect the commodities forecast. Our alternative estimate instead incorporates a real escalation of 0 per cent for commodity prices which, on the basis of the information before us, we consider is likely to provide a more reliable estimation for the price of input materials used by TransGrid to provide prescribed services. We have also not accepted TransGrid's proposed real escalation of labour prices on the basis of our reasoning in the opex rate of change appendix. In particular, we have forecast labour price change for the 2014–2018 period based on an average of the forecasts for the electricity, gas, water and waste services sectors from Deloitte and Independent Economics. Historically, an average has better reflected actual labour price changes for the electricity, gas, water services sectors.

Source: AER analysis

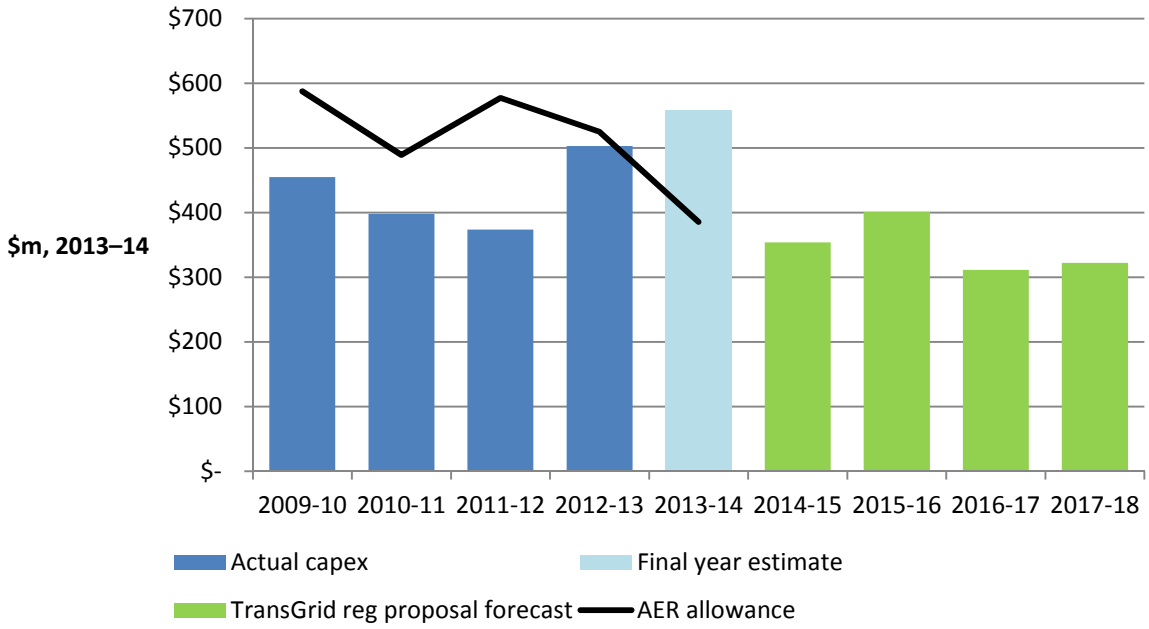
6.2 TransGrid's proposal

TransGrid proposed total forecast capex of $1,387.4 million ($2013–14) for the 2014–2018 period. This is 23 per cent lower on an average annual basis than the actual (estimated) capex that TransGrid spent during the 2009–2014 regulatory control period.

Figure 6-1 shows the reduction between TransGrid's proposal for the 2014–2018 period and the actual capex that it spent during the 2009–2014 regulatory control period. According to TransGrid, this proposed reduction is attributable to decreases in expenditure to meet expected changes in demand.[2]

[2] TransGrid, *Revenue Proposal,* May 2014.

Figure 6-1 TransGrid's actual and forecast total capex 2009–2018



Source: AER analysis

6.3 Assessment approach

This section outlines our approach to capex assessments. It sets out the relevant legislative and rule requirements, outlines our assessment techniques and explains how we build an alternative estimate of total forecast capex against which we compare that proposed by the service provider.

We will accept TransGrid's proposed total forecast capex if we are satisfied that it reasonably reflects the capex criteria.[3] If we are not satisfied, we replace it with our estimate of a total forecast capex that we are satisfied reasonably reflects the capex criteria.[4] The capex criteria are:

- the efficient costs of achieving the capital expenditure objectives
- the costs that a prudent operator would require to achieve the capital expenditure objectives
- a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives.

The Australian Energy Market Commission (AEMC) noted that '[t]hese criteria broadly reflect the NEO [National Electricity Objective]'.[5] The capital expenditure objectives (capex objectives) referred to in the capex criteria, are to:[6]

- meet or manage the expected demand for prescribed transmission services over the period
- comply with all regulatory obligations or requirements associated with the provision of prescribed transmission services

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3 NER, cl. 6A.6.7(c).
4 NER, cll. 6A.6.7(d) and 6A.14.1(2)(ii).
5 AEMC, *Final Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, 29 November 2012, p. 113 (AEMC Economic Regulation Final Rule Determination).
6 NER, cl. 6A.6.7(a).

- to the extent that there are no such obligations or requirements, maintain service quality, reliability and security of supply of prescribed transmission services and maintain the reliability and security of the transmission system
- maintain the safety of the transmission system through the supply of prescribed transmission services.

Importantly, our assessment is about the total forecast capex and not about particular categories or projects in the capex forecast. The AEMC has expressed our role in these terms:[7]

> It should be noted here that what the AER approves in this context is expenditure allowances, not projects.

In deciding whether we are satisfied that TransGrid's proposed total forecast capex reasonably reflects the capex criteria, we have regard to the capex factors. The capex factors are:[8]

1. the AER's most recent annual benchmarking report and benchmarking capex that would be incurred by an efficient TNSP over the relevant regulatory control period
2. the actual and expected capex of the TNSP during the preceding regulatory control periods
3. the extent to which the capex forecast includes expenditure to address the concerns of electricity consumers as identified by the TNSP in the course of its engagement with electricity consumers
4. the relative prices of operating and capital inputs
5. the substitution possibilities between operating and capital expenditure
6. whether the capex forecast is consistent with any incentive scheme or schemes that apply to the TNSP
7. the extent to which the capex forecast is referable to arrangements with a person other than the TNSP that, in the opinion of the AER, do not reflect arm's length terms
8. whether the capex forecast includes an amount relating to a project that should more appropriately be included as a contingent project
9. the most recent National Transmission Network Development Plan (NTNDP) and any submissions made by AEMO on the forecast of the TNSP's required capex
10. the extent to which the TNSP has considered, and made provision for, efficient and prudent non-network alternatives.
11. any relevant project assessment conclusions report under clause 5.6.6 of the National Electricity Rules (NER).

In addition, we may notify the TNSP in writing, prior to the submission of its revised revenue proposal, of any other factor it considers relevant.[9]

In taking these factors into account, the AEMC has noted that:[10]

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7 AEMC, *Economic Regulation Final Rule Determination*, p. vii.
8 NER, cl. 6A.6.7(e).
9 NER, cl. 6A.6.7(e)(14).
10 AEMC, *Economic Regulation Final Rule Determination*, p. 115.

> …this does not mean that every factor will be relevant to every aspect of every regulatory determination the AER makes. The AER may decide that certain factors are not relevant in certain cases once it has considered them.

For transparency and ease of reference, we have included a summary of how we have had regard to each of the capex factors in our assessment at the end of this attachment.

More broadly, we also note that in exercising our discretion, we take into account the revenue and pricing principles which are set out in the National Electricity Law.[11]

6.3.1 Recent AEMC rule changes

The rule changes the AEMC made in November 2012 require us to make and publish an Expenditure Forecast Assessment Guideline for Electricity Transmission (released in November 2013). The Guideline sets out our proposed general approach to assessing capex (and opex) forecasts. The rule changes also require us to set out our approach to assessing capex in the relevant framework and approach paper. For TransGrid, our framework and approach paper (published in January 2014) stated that we would apply the guideline, including the assessment techniques outlined in it. We may depart from our Guideline approach and if we do so, need to explain why. In this determination we have not departed from the approach set out in our Guideline.

As part of these rule changes, the AEMC also emphasised the role of benchmarking in our assessment of capex. In particular, we are now required to produce annual benchmarking reports. This is also a capex factor that we are now required to consider in assessing a capex proposal.[12] The AEMC removed the focus on a business' 'individual circumstances' as it could be an impediment to the use of benchmarking by the AER.[13]

6.3.2 Building our estimate of total forecast capex

Our starting point is the service provider's proposal.[14] We then considered the service provider's performance in the previous regulatory control period to inform our alternative estimate. We also reviewed the proposed forecast methodology and the service provider's reliance on key assumptions that underlie its forecast.

We then applied our specific assessment techniques, outlined below, to develop and estimate and assess the economic justifications that the service provider put forward. The specific techniques that we have used in this draft decision include:

- economic benchmarking—to assess a business's overall efficiency (and trends in efficiency) compared with other businesses, drawing on our annual benchmarking report
- trend analysis—forecasting future expenditure based on historical information, especially for recurrent and predictable categories of expenditure
- engineering review—including review of a TNSP's governance and risk and asset management processes, review of specific projects/programs and cost-benefit analysis to test whether the proposed expenditure is efficient and prudent.

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11 NEL, ss. 7A and 16(2).
12 NER, cl. 6A.6.7(e)(4).
13 AEMC, *National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, November 2012, p. 97.
14 AER, *Expenditure Forecast Electricity Transmission Guideline*, November 2013, p. 9; see also AEMC, *Economic Regulation Final Rule Determination*, pp. 111 and 112.

Some of these techniques focus on total capex; others focus on high level, standardised sub-categories of capex. Importantly, the techniques that focus on sub-categories are not conducted for the purpose of determining at a detailed level what projects or programs of work the service provider should or should not undertake. They are but one means of assessing the overall total forecast capex required by the service provider. This is consistent with the regulatory framework and the AEMC's statement that we do not approve projects. Once we approve total revenue, which will be determined by reference to our analysis of the proposed capex, the service provider will have to prioritise its capex program given the prevailing circumstances at the time (such as demand and economic conditions that impact during the regulatory period). Most likely, some projects or programs of work that were not anticipated will be required. Equally likely, some of the projects or programs of work that the service provider has proposed for the regulatory control period will not be required. We consider that acting prudently and efficiently, the service provider will consider the changing environment throughout the regulatory period and make sound decisions taking into account their individual circumstances.

Many of our techniques encompass the capex factors that we are required to take into account. These techniques are discussed in more detail in appendix A.

As explained in our Guidelines:

> Our assessment techniques may complement each other in terms of the information they provide. This holistic approach gives us the ability to use all of these techniques, and refine them over time. The extent to which we use each technique will vary depending on the expenditure proposal we are assessing, but we intend to consider the inter-connections between our assessment techniques when determining total capex … forecasts. We typically would not infer the findings of an assessment technique in isolation from other techniques.[15]

In arriving at our estimate, we have had to weight the various techniques used in our assessment. How we weight these techniques will be determined on a case by case basis using our judgement as to which techniques are more robust.[16] We also need to take into account the various interrelationships between the total forecast capex and other components of a service provider's transmission determination. We identify these interrelationships below. In particular, the other components that directly affect the total forecast capex are forecast demand, real cost escalation and contingent projects. We discuss how these components impact the total forecast demand in the appendices.

Underlying our approach are two general assumptions:

- Capex criteria relating to a prudent operator and efficient costs are complementary such that prudent and efficient expenditure reflects the lowest long-term cost to consumers for the most appropriate investment or activity required to achieve the expenditure objectives.
- Past expenditure was sufficient for TransGrid to manage and operate its network in that previous period, in a manner that achieved the capex objectives.

After applying the above approach, we arrive at our estimate of the total capex forecast.

6.3.3 Comparing the service provider's proposal with our estimate

Having established our estimate of the total forecast capex, we can test the service provider's proposed total forecast capex. This includes comparing our alternative estimate of forecast total

capex with the service provider's forecast total. The service provider's forecast methodology and its key assumptions may explain any differences between our alternative estimate and its proposal.

As the AEMC foreshadowed, we may need to exercise our judgement in determining whether any 'margin of difference' is reasonable:[17]

> The AER could be expected to approach the assessment of a NSP's expenditure (capex or opex) forecast by determining its own forecast of expenditure based on the material before it. Presumably this will never match exactly the amount proposed by the NSP. However there will be a certain margin of difference between the AER's forecast and that of the NSP within which the AER could say that the NSP's forecast is reasonable. What the margin is in a particular case, and therefore what the AER will accept as reasonable, is a matter for the AER exercising its regulatory judgment.

We have not relied solely on any one technique to assist us in forming a view as to whether we are satisfied that a service provider's capex proposal reasonably reflects the capex criteria. We have necessarily drawn on a range of techniques as well as our assessment of demand, real cost escalators and contingent projects.

Where we approve a service provider's proposed total forecast capex or where we substitute our estimate of total forecast capex, it is important to recognise that the service provider is not precluded from undertaking unexpected capex works, if the need arises, and despite the fact that such works did not form part our assessment in this determination. As noted above, we anticipate that a service provider will prioritise their capex program of works. Where an unexpected event leads to an overspend of the capex amount approved in this determination as part of total revenue, a service provider will only be required to bear 30 per cent of this cost if the expenditure is found to be prudent and efficient. Further, for significant unexpected capex, the pass-through provisions provide a means for a service provider to pass on such expenses to customers where appropriate. For these reasons, in the event that the approved total revenue underestimates the total capex required, we do not consider that this should lead to undue safety or reliability issues. Conversely, if we overestimate the amount of capex required, the stronger incentives put in place by the AEMC in 2012 should lead to a business spending only what is efficient, with the benefits of the underspend being shared between businesses and consumers.

6.4 Reasons for draft decision

We are not satisfied that TransGrid's total forecast capex reasonably reflects the capex criteria. We compared TransGrid's capex forecast to a capex forecast we constructed using the approach and techniques outlined above. TransGrid's proposal is materially higher than ours. We are satisfied that our alternative estimate reasonably reflects the capex criteria.

Table 6-3 sets out the capex amounts by capex driver that we have included in our alternative estimate of TransGrid's total forecast capex for the 2014–2018 period.

[17] AEMC, *Economic Regulation Final Rule Determination*, p. 112.

Table 6-3 Our assessment of required capex by capex driver ($ million 2013–14)

Capex driver	2014–15	2015–16	2016–17	2017–18	Total
Augex	16.92	4.82	22.69	20.70	65.14
Connections capex	4.71	0.95	1.12	0.19	6.98
Repex (including security and compliance expenditure)	178.86	191.66	157.60	165.65	693.76
Strategic land acquisitions	0.90	2.15	7.85	–	10.90
Non-network capex	39.45	39.82	33.73	32.56	145.56
Total annual capex	**240.84**	**239.40**	**222.99**	**219.10**	**922.34**

Source: AER analysis
Note: Numbers may not total due to rounding.

Our assessment of TransGrid's forecasting methodology, key assumptions and past capex performance are discussed below. Our assessment of capex drivers is in appendix A. Appendix A discusses the application of our assessment techniques to the capex drivers and the weighting we gave to particular techniques. Our reasoning in the appendices forms the basis of our alternative estimate.

TransGrid is required to inform us about the methodology it proposes to use to prepare its forecast capex allowance before it submits its revenue proposal.[18] It is also required to include this information in its revenue proposal.[19]

The main points of TransGrid's forecasting methodology are:[20]

- TransGrid has used a bottom up build to derive its forecast capex for all of its capital programs and projects. Its capital projects are scoped to meet specific needs, whereas its capital programs group similar minor projects.
- Each capital project or program is justified on the basis of technical requirements and a cost-benefit evaluation. They are compiled in TransGrid's capital accumulation model. They fall into the categories of future or committed projects or programs.
- At the portfolio level, TransGrid's proposed forecast capex represents the most likely or average estimated cost of delivery.
- TransGrid has applied its approved cost allocation method so that all forecast capex is allocated to prescribed transmission services.
- TransGrid's proposed forecast capex does not include expenditure to improve performance under the STPIS.

We have identified two aspects of TransGrid's forecasting methodology which indicate that its methodology is not a sufficient basis on which to conclude that its proposed total forecast capex reasonably reflects the capex criteria.

18 NER, cll. 6A.10.1B and 11.58.4(n); TransGrid, *Approach to Forecasting*, November 2013.
19 NER, cll. S6A.1.1(2); TransGrid, *Revenue proposal*, May 2014, pp. 87–91.
20 TransGrid, *Revenue proposal*, May 2014, pp. 87–91.

First, TransGrid's forecasting methodology applies a bottom-up build (or bottom-up assessment) to estimate the forecast expenditure for all its capital programs and projects. It does not involve applying a top-down assessment. In our view, applying a top-down assessment is a critical part of the process in deriving a forecast capex allowance. It indicates that some level of overall restraint has been brought to bear. This is an important factor for us to consider in deciding whether we are satisfied that a proposed forecast capex allowance reasonably reflects the capex criteria. In particular, to derive an estimate of capex by solely applying a bottom-up assessment does not itself provide any evidence that the estimate is efficient. Bottom-up assessments have a tendency to overstate required allowances as they do not adequately account for inter-relationships and synergies between projects or areas of work which are more readily identified at a portfolio level. Whilst in certain very limited circumstances, a bottom up build may be a reasonable approach to justifying expenditure; this is not the case when looking at aggregated areas of expenditure or at the portfolio level. Simply aggregating such estimates at the project level is unlikely to result in a total forecast capex allowance that we are satisfied reasonably reflects the capex criteria.

As we stated in our Forecast Expenditure Assessment Guidelines, we intend to assess forecast capex proposals through a combination of top down and bottom up modelling.[21] Our top-down assessment of TransGrid's proposed forecast is a material consideration in determining whether we are satisfied it reasonably reflects the capex criteria. For example, trend analysis is a top-down assessment that can be applied in the context of a transmission network. This technique is able to test whether an estimate that results from a bottom-up assessment might be efficient. We have used this technique in this determination.

A top-down assessment should also clearly evidence a holistic and strategic consideration or assessment of the entire forecast capex program at a portfolio level. It should also demonstrate how the forecast capex proposal has been subject to governance and risk management arrangements. In turn, these arrangements should demonstrate how the timing and prioritisation of certain capital projects or programs has been determined over both the short and the long-term. It should also demonstrate that the capex drivers, such as asset health and risk levels, are well defined and justified. In particular, asset health and risk level metrics are key elements of capex drivers.

TransGrid's forecast methodology does not demonstrate any of these points.

Second, TransGrid's cost-benefit evaluation of each of its capital projects or programs reveals that its underlying risk assessment is overly conservative. TransGrid did not adequately justify the timing and priority of its proposed forecast capex. In particular, TransGrid did not demonstrate that it has appropriately considered the extent to which its programs or projects can be deferred to the 2019–2022 regulatory control period. Ultimately, this overly conservative approach to risk means that TransGrid is likely to have forecasted more capex in the 2014–2018 period that is necessary to achieve the capex objectives. The same views have also been expressed by EMCa in their review of TransGrid's proposed repex.[22]

These two deficiencies in TransGrid's forecasting methodology have been material to our view that we are not satisfied that TransGrid's proposed total forecast capex reasonably reflects the capex criteria.

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[21] AER, *Expenditure Forecast Electricity Transmission Guideline*, November 2013, p. 17.

[22] EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2018, Report to Australian Energy Regulator,* 3 October 2014, pp. 5 and 8–24.

6.4.1 Key assumptions

The NER require TransGrid to include in its revenue proposal the key assumptions that underlie its proposed forecast capex and a certification by its directors that those key assumptions are reasonable.[23]

TransGrid's key assumptions concern various standards, forecasts, models and inputs. To the extent that TransGrid has relied on its key assumptions to justify its capex proposal, we have addressed these key assumptions in appendix C (demand) and appendix D and the opex rate of change appendix (forecast materials escalation rates and labour escalation rates, respectively).

We have identified concerns with some of the key assumptions relied upon by TransGrid either in how they were formulated or applied. These concerns are relevant to us not being satisfied that TransGrid's forecast capex reasonably reflects the capex criteria.

6.4.2 TransGrid's capex performance

We have looked at a number of historical metrics of TransGrid's capex performance to help inform our assessment of TransGrid's proposed capex forecast. This includes TransGrid's relative multilateral total factor productivity (MTFP) performance from our annual benchmarking report, and its proposed forecast capex allowance against historical trends.

Generally, these results show that, while TransGrid is proposing lower capex than its historical average, its overall expenditure efficiency is materially lower than that achieved by TasNetworks and ElectraNet. More importantly, its capital efficiency has been steadily declining over time. These observations suggest that there is the potential for efficiencies to be found in TransGrid's proposed forecast capex.

We have not placed much weight on the other results from our annual benchmarking report. As noted in the report, it is difficult to draw any firm conclusions regarding the relative efficiency of the transmission networks based upon the benchmarking results. This is because the relative efficiency of the networks change depending on the measure selected, the limited number of TNSPs and the relative infancy of economic benchmarking in relation to MTFP.

Figure 6-2 shows TransGrid's MTFP performance over time and relative to the other TNSPs. MTFP measures how efficient a business is in terms of its inputs (costs) and outputs (customer numbers, ratcheted maximum demand, reliability, circuit line length and energy delivered). These results show that TransGrid's efficiency is low and has been declined steadily over time.

[23] NER, cll. S6A.1.1(2), (4) and (5). TransGrid, *Revenue Proposal*, May 2014, p. 110 and Appendix B.

Figure 6-2 Relative MTFP performance of transmission networks

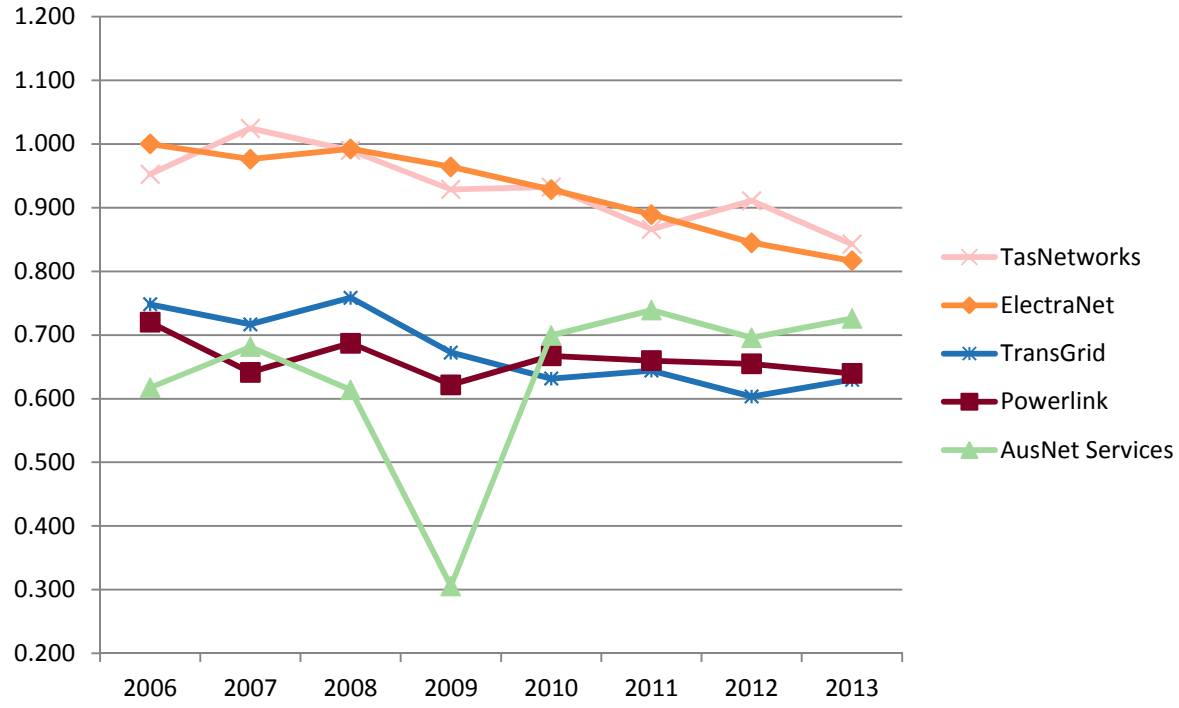
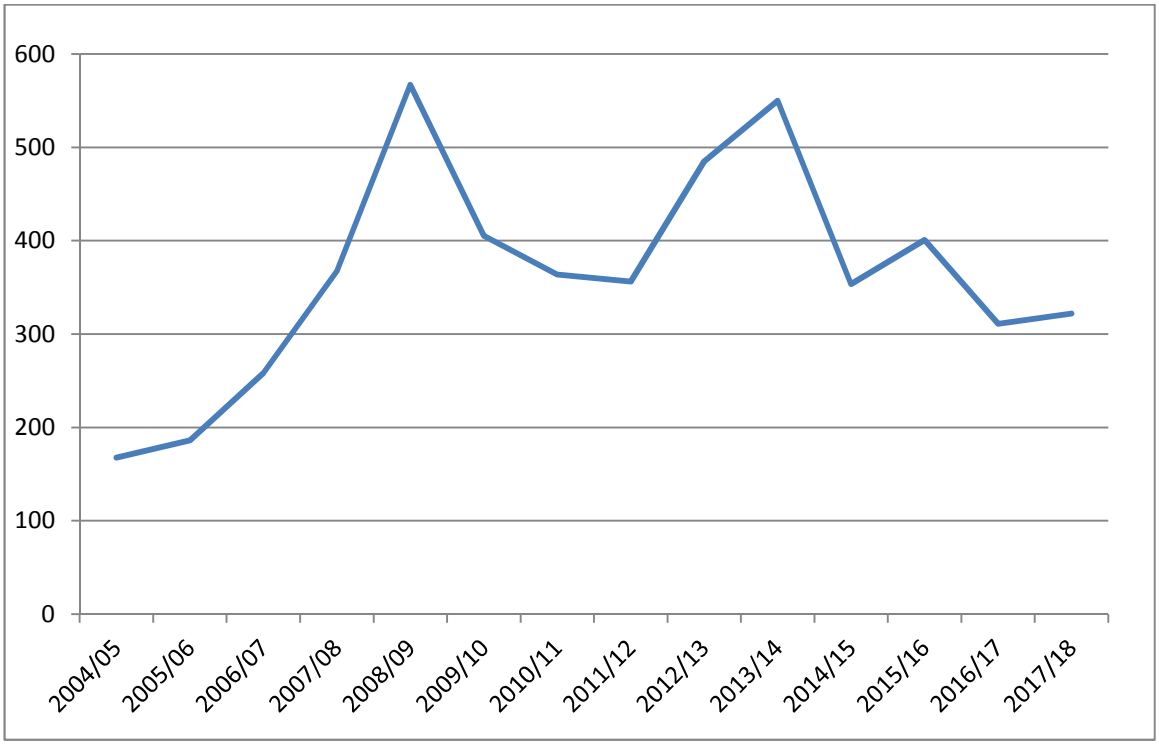


Figure 6-3 shows TransGrid's proposed forecast capex against historical trends ($2013–14). This indicates that capex is declining when compared to the recent trends. The average annual capex allowance for the 2014–2018 period is marginally lower than the average of the capex TransGrid spent between the years 2004–05 and 2013–14.

Figure 6-3 Historic capex and forecast capex for TransGrid (million $2013/14)



6.4.3 Interrelationships

There are a number of interrelationships between TransGrid's total forecast capex for the 2014–2018 period and other components of its transmission determination that we have taken into account in coming to our draft decision. Table 6-4 summarises these other components and their interrelationships with TransGrid's total forecast capex.

Table 6-4 Interrelationships between total forecast capex and other components

Other component	Interrelationships with total forecast capex
Total forecast opex	There are elements of TransGrid's total forecast opex that are related to its total forecast capex. These are: ▪ the labour cost escalators that we approved in (refer to opex rate of change appendix) ▪ the amount of maintenance opex that is reflected in TransGrid's opex base year that we approved in [Attachment 7) The labour cost escalators are related because TransGrid's total forecast capex includes expenditure for capitalised labour. As to the amount of maintenance opex, although we did not approve a specific amount of maintenance opex as part of assessing TransGrid's total forecast opex, it is related. This is because the amount of maintenance opex that is reflected in TransGrid's opex base in part determines the extent to which TransGrid needs to spend repex during the 2014–2018 period.
Forecast demand	Forecast demand is related to the amount of forecast growth driven capex that is included in TransGrid's total forecast capex. Growth driven capex, which includes augex and customer connections capex, is typically triggered by a need to build or upgrade a network to address changes in demand or to comply with quality, reliability and security of supply requirements. Hence, the main driver of growth-related capex is maximum demand and its effect on network utilisation and reliability.
Capital Expenditure Sharing Scheme (CESS)	The CESS is related to TransGrid's total forecast capex. In particular, the effective application of the CESS is contingent on the approved total forecast capex being efficient, or that it reasonably reflects the capex criteria. As noted in Table 6-5, this is because any efficiency gains or losses are measured against the approved total forecast capex. In addition, in future transmission determinations we will be required to undertake an ex post review of the efficiency and prudency of capex, with the option to exclude any inefficient capex in excess of the approved total forecast capex from TransGrid's regulatory asset base. In particular, the CESS will ensure that TransGrid bears at least 30 per cent of any overspend against the capex allowance. Similarly, if TransGrid can fulfil their objectives without spending the full capex allowance, it will be able to retain 30 per cent of the benefit of this.
Service Standards Performance Incentive Scheme (STPIS)	The STPIS is related to TransGrid total forecast capex, in so far as it is important that it does not include any expenditure for the purposes of improving supply reliability during the 2014–2018 period.
Contingent project	A contingent project is related to TransGrid's total forecast capex. This is because an amount of expenditure that should be included as a contingent project should not be included as part of TransGrid's total forecast capex for the 2014–2018 period. We did not identify any part of TransGrid's forecast ex-ante capex forecast that we consider should be included as a contingent project. However, we have not accepted TransGrid's proposed contingent project related to the inner Sydney and CBD area. As a consequence, we have not accepted some proposed capex for the acquisition of land in the ex-ante allowance associated with this project.

Source: AER analysis

6.4.4 Consideration of the capex factors

In deciding whether or not we are satisfied Ausgrid's forecast reasonably reflects the capex criteria, we have had regard to the following capex factors when applying our assessment techniques to the total proposed capex forecast, and where relevant, to different sub-categories of proposed expenditure. Table 6-5 summarises how we have taken into account the capex factors.

Table 6-5 AER consideration of capex factors

Capex factor	AER consideration
The most recent annual benchmarking report and benchmarking capex that would be incurred by an efficient TNSP over the relevant regulatory control period	We have had regard to our most recent benchmarking report in assessing TransGrid's proposed total forecast capex and in determining our alternative estimate for the 2014–2018 period. This can be seen in the metrics we used in our assessment of TransGrid's capex performance.
The actual and expected capex of TransGrid during any preceding regulatory control periods	We have had regard to TransGrid's actual and expected capex during the 2009–2014 and preceding regulatory control periods in assessing its proposed total forecast capex and in determining our alternative estimate for the 2014–2018 period. This can be seen in our assessment of TransGrid's capex performance. It can also be seen in our assessment of the forecast capex associated with each of the capex drivers that underlie TransGrid's total forecast capex. In these cases, we have applied trend analysis which is reasonably likely to be recurrent in nature (e.g. compliance related expenditure, non-network related expenditure and replacement related expenditure).
The extent to which the capex forecast includes expenditure to address concerns of electricity consumers as identified by TransGrid in the course of its engagement with electricity consumers	We have had regard to the extent to which TransGrid's proposed total forecast capex includes expenditure to address consumer concerns that have been identified by TransGrid. On the information available to us, including submissions received from stakeholders, we have been unable to identify the extent to which TransGrid's proposed total forecast capex includes capex that address the concerns of its consumers that it has identified.
The relative prices of operating and capital inputs	We have had regard to the relative prices of operating and capital inputs in assessing TransGrid's proposed real cost escalation factors for materials. We discuss this in Appendix D.
The substitution possibilities between operating and capital expenditure	We have had regard to the substitution possibilities between opex and capex. We have considered whether there are more efficient and prudent trade-offs in investing more or less in capital in place of ongoing operations. See our discussion about the interrelationships between TransGrid's total forecast capex and total forecast opex in Table 6-4 above.
Whether the capex forecast is consistent with any incentive scheme or schemes that apply to TransGrid	We have had regard to whether TransGrid's proposed total forecast capex is consistent with the CESS and the STPIS. See our discussion about the interrelationships between TransGrid's total forecast capex and the application of the CESS and the STPIS in Table 6-4 above.
The extent to which the capex forecast is referable to arrangements with a person other than the DNSP that	We have had regard to whether any part of TransGrid's proposed total forecast capex or our alternative estimate that is referable to arrangements with a person other than TransGrid that do not reflect

Capex factor	AER consideration
do not reflect arm's length terms	arm's length terms. We did not identify any parts of TransGrid's proposed total forecast capex or our alternative estimate that is referable in this way.
Whether the capex forecast includes an amount relating to a project that should more appropriately be included as a contingent project	We have had regard to whether any amount of TransGrid's proposed total forecast capex or our alternative estimate relates to a project that should more appropriately be included as a contingent project. We have not identified any expenditure that would more appropriately be included as contingent project. We have not accepted TransGrid's proposed contingent projects as discussed in Appendix E.
The most recent National Transmission Network Development Plan (NTNDP), and any submissions made by AEMO, in accordance with the Rules, on the forecast of TransGrid's required capex	We have taken into account the most recent NTNDP and submissions made by AEMO in assessing TransGrid's forecast augex. See Appendix A.
The extent to which TransGrid has considered and made provision for efficient and prudent non-network alternatives	We have had regard to the extent to which TransGrid made provision for efficient and prudent non-network alternatives. TransGrid did not make provision for such non-network alternatives. We also have not identified any such non-network alternatives that we would include our alternative estimate.
Any relevant project assessment conclusions report required under clause 5.6.6 of the NER	There are no relevant project assessment conclusions reports relevant to TransGrid for us to have regard to.
Any other factor the AER considers relevant and which the AER has notified TransGrid in writing, prior to the submission of its revised Revenue Proposal, is a capex factor	We did not identify any other capex factor that we consider relevant.

Source: AER analysis

A Assessment of forecast capex drivers

As we discuss in attachment 6 we are not satisfied that TransGrid's proposed total forecast capital expenditure (capex) reasonably reflects the capex criteria. This conclusion is based in part on our analysis of the capex drivers that underlie TransGrid's forecast capex for the 2014–2018 period as set out in this appendix. This analysis also explains the basis for our alternative estimate of TransGrid's total forecast capex that we are satisfied reasonably reflects the capex criteria.

This appendix considers each capex driver as follows:

- Section A.1: augmentation capex (augex)
- Section A.2: customer connections capex
- Section A.3: asset replacement capex (repex and security and compliance)
- Section A.4: strategic property acquisitions
- Section A.5: non-network capex

In each section we present our views on the amount of capex for each sub-category that is included in our alternative estimate of TransGrid's total forecast capex that we are satisfied reasonably reflects the capex criteria (alternative estimate).

A.1 AER findings and estimate for augex

Growth driven capex is typically triggered by a need to build or upgrade a network to address changes in demand or to comply with quality, reliability and security of supply requirements. Hence, the main driver of growth-related capex is maximum demand and its effect on network utilisation and reliability. Growth-driven capex includes augmentations and new connections.

A.1.1 AER position

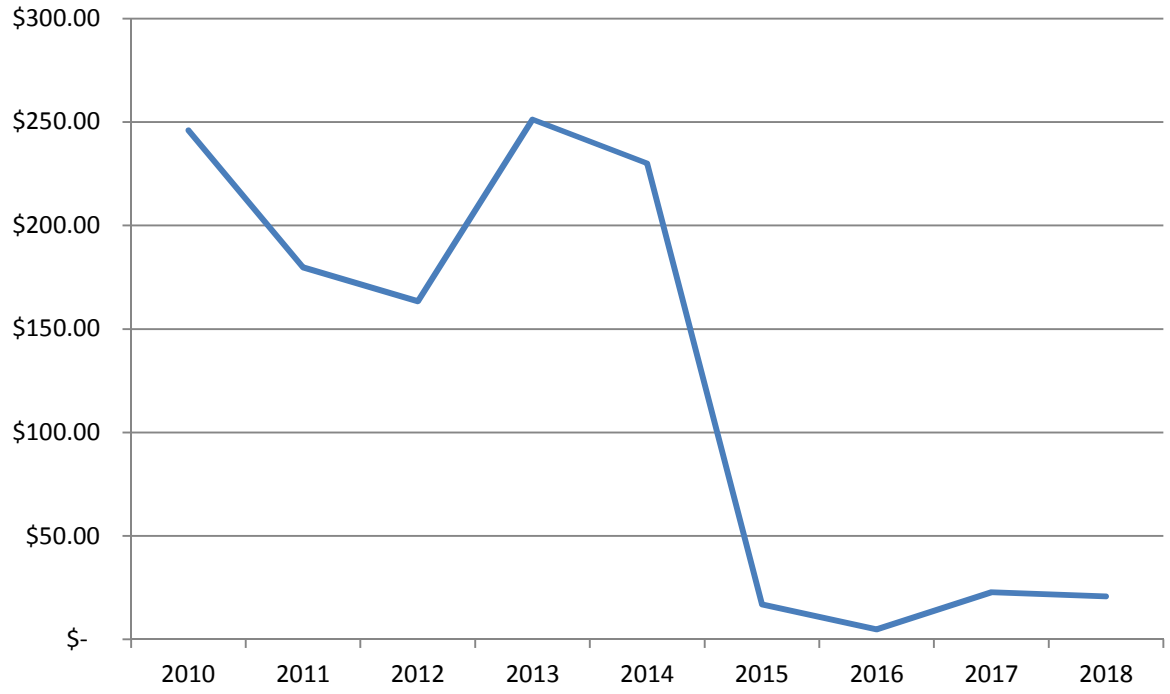
TransGrid proposed $72.1 million ($2013–14) for growth-related capex for the 2014–2018 period. Of this, $65.1 million ($2013–14) is for augex. We accept TransGrid's proposed expenditure for augex and have included it in our alternative estimate.

In forming our view, we applied our assessment approach as set out in attachment 6. Specifically, we applied:

- trend analysis, comparing the proposed augex with historic expenditure levels
- the impact of forecast maximum demand on TransGrid's network
- the independent assessment undertaken by AEMO.

Figure A-1 shows that this is a significant reduction from the amount of augex TransGrid spent during the 2009–2014 period. The average annual augex for the 2014–2018 period is $197.7 million ($2013–14) lower than for the 2009–2014 regulatory control period. This is a 92 per cent reduction.

Figure A-1: **TransGrid's augex–historic and proposed for 2014-18 period (million $2013/14)**



Source: TransGrid, CAPEX Accumulation Model and AER analysis.

The significant reduction in forecast augex is consistent with the reduction in forecast system-wide demand, and the evidence that demand may stagnate or continue to fall, during the 2014–18 period. As noted in appendix C, we accept TransGrid's demand forecasts for the purposes of this draft decision, but we understand the NSW distributors are in the process of further updating their demand forecasts. We will consider the impact of updated demand forecasts and other information in our final decision. To the extent that there is evidence of a lower system demand forecast, we would expect a further downward revision of TransGrid's forecast augex in its revised revenue proposal.

TransGrid's augex of $65.1 million ($2013–14) is driven by two projects that are proposed to address localised demand and reliability requirements:

- The second supply to the Australian Capital Territory (ACT)—this is a jurisdictional reliability standard driven project. TransGrid is working with the ACT Government to establish a new switching station and a short section of transmission line as part of a second supply to the ACT. The estimated cost of the project is $31.4 million ($2013–14).[24]
- The reinforcement of supply to Gunnedah, Narrabri and Moree (forecast to cost $15.3 million ($2013–14))[25]—this is a load driven project. TransGrid proposes to install a phase shifting transformer at the Tamworth 330kV substation.

AEMO provided an independent view of the transmission network investment needs of TransGrid's network. Its report provided an independent assessment of these two augex projects. We are required to take this report into account.[26] This report assessed the extent to which TransGrid's proposed growth capex is required to address transmission network needs, and whether an alternative option

[24] TransGrid, *Revenue Proposal,* May 2014 p. 72.
[25] TransGrid, response to the AER's 13 October 2014 information request, 21 October 2014, and AER analysis.
[26] AEMO, *Independent Planning Review New South Wales and Tasmanian Transmission Networks*, August 2014; Attachment A: TransGrid Project Assessment Report; NER, cl. 6A.6.7(e)(11).

could better support the efficient operation of and investment in TransGrid's network in the long term interests of consumers.[27]

AEMO found that these projects were justified,[28] and in particular that:

- there is justified network need for the second supply to the ACT.[29]
- TransGrid's proposal to install a phase shifting transformer to induce more flow to supply the Gunnedah, Narrabri and Moree area is a credible option.[30]

AEMO's process was open and consultative and involved engagement with TransGrid. It resulted in significant change in TransGrid's approach between its proposal for the transitional regulatory control period (2013–14) and its proposal for the subsequent period (2014–2018). Following its engagement with AEMO and in consideration of its revised demand forecasts, TransGrid substantially reduced its capex forecast for the 2014–2018 period by $180 million ($2013–14).[31] The amendments TransGrid made to its augex proposal between its proposal for the transitional regulatory control period and its proposal for the subsequent period aligns with the findings in AEMO's TransGrid Project Assessment Report.[32]

Of this change to TransGrid's forecast augex, the Consumer Challenge Panel submitted:

> TransGrid's transitional proposal proposed $337M of augmentation capex for the next regulatory period. This was subsequently reduced to $77M in their full proposal, although some of the projects that were previously classified as "augmentation projects" in the transitional proposal were moved to other capex categories in the full proposal, particularly to the "support business" category…We expect the AER to ensure that all of TransGrid's augmentation projects are appropriately categorised and scrutinised.[33]

We have noted these changes in conducting our assessment. Specifically, the large reduction in TransGrid's forecast expenditure for growth related capex was partially offset by forecast increases in replacement expenditure. We have assessed TransGrid's replacement expenditure in section A.3.

As per the trend analysis discussed above, there has been a significant decline in the total augex forecast and it is now a relatively small proportion of overall expenditure. Based on our trend analysis and AEMO's independent assessment and technical analysis, we consider that TransGrid's proposed forecast of $65.1 million ($2013–14) for augex reasonably reflects the expenditure required to meet the expenditure criteria. We will include an allowance for this amount in our estimate of total capex for the 2014–2018 period.

For future growth related capex forecast assessments, we intend to review the extent to which proposals are consistent with the independent reviews undertaken by AEMO. We will focus our attention on areas of inconsistency between the proposal and the independent AEMO assessment. Where augex makes up a significant proportion of the total capex forecast, we may undertake a review of the cost estimates used in the forecast. This is because AEMO's process only assesses whether the need for the network expenditure has been justified and whether any other alternatives should have been considered. AEMO does not undertake a review of the costs associated with the projects, even where they determine that the project has been justified.

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27 AEMO, *Independent Planning Review New South Wales and Tasmanian Transmission Networks*, August 2014, pp. 1, 5.
28 AEMO, *Attachment A -TransGrid Project Assessment Reports Independent Planning Review*, August 2014.
29 AEMO, *Attachment A -TransGrid Project Assessment Reports Independent Planning Review*, August 2014, p. 22.
30 AEMO, *Attachment A -TransGrid Project Assessment Reports Independent Planning Review*, August 2014, p. 11.
31 TransGrid, *Revenue Proposal*, May 2014, p. 70, TransGrid, *Transitional Revenue Proposal* 2014/15, p. 24.
32 AEMO, *Independent Planning Review, New South Wales and Tasmanian Transmission Networks*, August 2014, p. 13.
33 AER Consumer Challenge Panel submission on the TransGrid Revenue Proposal, Panel members, Hugh Grant and Ruth Lavery, 8 August 2014, p.8.

A.2 AER findings and estimates for connections capex

Connections capex for transmission networks is necessary to meet joint planning requirements with surrounding distribution networks.

TransGrid proposed $6.98 million ($2013–14) for connections capex for the 2014–2018 period. This represents a 47 per cent reduction from the 2009–2014 regulatory control period.

We are satisfied that TransGrid's proposed connections capex reflects the trend in reduced demand, as identified in our trend analysis, as well as capacity constraints of surrounding distribution networks in NSW during the 2009–2014 regulatory control period.

However, as noted previously, we understand the NSW DNSPs are in the process of further updating their demand forecasts. We will consider the impact of updated demand forecasts on connections expenditure and other information in our final decision. To the extent that there is evidence of a lower system demand forecast, we would expect a further downward revision of TransGrid's connections forecast in its revised revenue proposal.

A.3 AER findings and estimates for asset replacement related expenditure (repex and security and compliance)

Asset replacement expenditure (repex) involves replacing an asset with its modern equivalent where the asset has reached the end of its economic life. Economic life takes into account the age, condition, technology or operating environment of an existing asset. In general, we classify capex as repex where the expenditure decision is primarily based on the existing asset's inability to efficiently maintain its service performance requirement.

Expenditure on assets for security and compliance involves modifying an asset for reasons other than an increase in demand. This includes for safety reasons. The majority of the proposed expenditure is to rectify low transmission line spans.

A.1.1 Position

TransGrid proposed $925.2 million ($2013–14) of forecast repex and $129.6 million ($2013–14) for forecast security and compliance capex.[34] We do not accept TransGrid's proposal. We have instead included an amount of $693.8 million ($2013–14) in our alternative estimate, a reduction of 34 per cent. This constitutes $647.6 million ($2013–14) of forecast repex and $46.1 million of forecast security and compliance capex. In coming to this view, as we discuss in Appendix B, we applied:

- trend analysis, comparing past trends in total actual and forecast repex and key repex programs[35]
- an engineering/technical assessment by Energy Market Consulting associates (EMCa).

Our findings are:

- compared to the 2009–2014 regulatory control period, TransGrid's proposed total repex (and its proposed repex for substation renewal, secondary system replacement, communication upgrades and transmission line life extension projects) is a significant step increase of around 48 per cent on an average annual basis.

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[34] TransGrid, *Capex accumulation model,* May 2014.
[35] NER, cl. 6A.6.7(e)(5).

- the associated unit costs are reasonable.

- TransGrid's proposed forecast repex is overstated in the order of 30 per cent. We have come to this view on the basis of the systemic issues that EMCa has identified in TransGrid's proposal. It appears that TransGrid has systemically overstated the risks associated with its assets and as a result its proposal is unjustifiably biased upwards. In particular, we accept the following findings that EMCa made in relation to each of TransGrid's four key repex programs:

  - opportunities have not been identified to defer and/or reduce the scope of projects

  - there is evidence that the quantification of the project risk costs is likely to be overstated

  - a consideration of lower cost options to address risks has not been demonstrated

  - there are examples where there is the replacement of relatively new assets as part of a broader asset replacement project for some assets

  - there is likely to be the potential to extend the life of some assets by using existing assets as spares

  - there is no evidence of performance issues for specific assets that would support a substantial increase in replacement needs

  - it appears that some assets are targeted for replacement based on replacement technology strategies rather than on asset condition grounds.

- We have placed significant weight on the outcomes of EMCa's technical review of TransGrid's governance and risk management, cost forecasting method and four key proposed repex programs. We have also placed significant weight on our trend analysis, given a significant proportion of TransGrid's proposal is comprised of discrete projects/programs that can be more readily assessed through project/program review rather than through benchmarking or predictive modelling. In addition we have placed limited weight on benchmarking analysis which measures historical performance for the reasons outlined in attachment six above.

- We have reduced TransGrid's proposed forecast repex by 30 per cent. Whilst this is at the higher end of the range proposed by EMCa, it is warranted in light of the real concerns we have with certain aspects of TransGrid's forecasting methodology. In particular, TransGrid's forecasting methodology is largely based on a bottom-up assessment approach that is excessively risk-averse. It also does not reflect the prudent consideration of its forecast capex at a portfolio level nor strategically throughout the 2014–2018 period.

- We have also found that the same systemic issues are likely to have affected the volume and scope of TransGrid's proposed security and compliance capex. The majority of this capex is for low transmission line spans. The systemic issues are particularly prevalent in TransGrid's risk assessment of its low transmission line spans, which are significantly overstated. This reflects a bias towards the selection of options that seek to eliminate the hazard and which result in cost estimates that are not efficient and prudent. It also reflects the systemic overestimation in the project risk cost with an estimated bias in the order of at least two if not three orders of magnitude in the expected value of this risk. In our view, it is likely that the total of TransGrid's proposed security and compliance expenditure is subject to these biases. It therefore overstates the forecast capex necessary for TransGrid to comply with specific obligations (e.g. statute, licence conditions, regulations). Our analysis indicates that TransGrid's proposed forecast capex associated with low transmission spans should be reduced by 85 per cent. We have also reduced

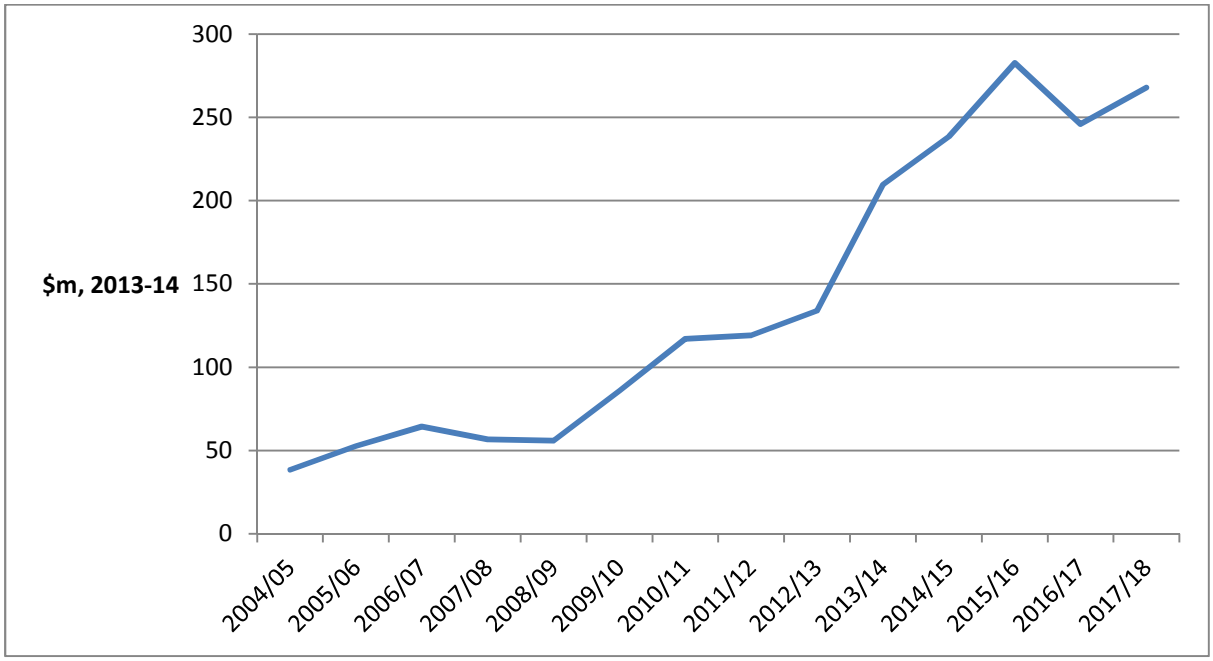
the remainder of TransGrid's proposed security and compliance capex by 30 per cent, consistent with our views on TransGrid's proposed forecast repex.

A significant proportion of transmission expenditure is typically lumpy in nature. We have therefore not relied on predictive modelling for this review of repex. This may be possible in the future as we collect more time series data. A longer time series of data will allow the predictive model to better predict when discrete and lumpy repex is likely to take place.

Trend analysis

TransGrid's proposed average annual repex over the 2014–2018 period is $231.3 million ($2013–14) per year. This compares to average annual repex of $155.8 million ($2013–14) over the 2009–2014 regulatory control period, an increase of 48 per cent.[36] This substantial increase is shown in Figure A-2. The actual repex that TransGrid spent during the 2009–2014 regulatory control period is also a significant overspend in comparison to the forecast. Several submissions expressed concern at the increase in TransGrid's proposed repex.[37]

Figure A-2: Repex actual and forecast trend from 2004-05, (inflation adjusted)



Source: AER analysis; TransGrid, *Revenue proposal 2014/15-2018/19,* May 2014, pp. 70 & 98.

TransGrid submitted that the significant increase in forecast repex in the 2014–2018 period is because many of its assets, which were built in the 1950s and 1960s, are reaching the end of their serviceable lives.[38]

Based on the available information on which our trend analysis is based, it does appear that the proposed increase in forecast repex in comparison to that which TransGrid spent in the 2009–2014 regulatory control period may be understated. This is due to TransGrid reallocating some augex to

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36 TransGrid, *Capex accumulation model,* May 2014.

37 Origin, *Submission to TransGrid's regulatory proposal,* 8 August 2014, p. 4; Energy Markets Reform Forum, *Response to TransGrid application,* July 2014, pp. 65-68; EUAA, *Submission on TransGrid's revenue proposal 2014–2018,* 8 August 2014; Norske Skog, *Response to TransGrid's application,* 8 August 2014, pp. 9-10.

38 TransGrid, *Revenue proposal,* May 2014, p. 66.

repex in the 2009–2014 regulatory control period.[39] As stated earlier, the actual repex that TransGrid spent during the 2009–2014 regulatory control period was significantly higher than forecast. Whilst it may be prudent to reduce augex in the face of declining demand growth, as EMCa comments, it is only prudent to increase repex above what was previously approved to the extent that there is: [40]

- an unanticipated increase in some program driver; or
- a realisation of additional unanticipated asset risk.

We agree with EMCa's view that there would be serious concerns about TransGrid's governance processes if neither of these factors can be shown to exist.[41] This is because the different cost drivers between repex and augex mean that these expenditure categories are not substitutable. Decisions to increase spending on asset replacement in the face of lower demand and a reduced need for augmentation spending need to be made on the basis of specific criteria related to asset condition and risk analysis.

The AER Consumer Challenge Panel (CCP) raised similar concerns regarding the reallocation of augex to repex in the 2009–2014 regulatory control period. It commented that TransGrid has effectively 'pre-installed' a good deal of its repex requirement for the 2014–2018 period.[42] In response to the CCP, TransGrid submitted that it plans and prioritises asset replacement based on condition and specific needs. TransGrid also submitted that the early stages of project planning must commence sufficiently in advance of the 2014–2018 period for some projects that are due to be commissioned early in the 2014–2018 period.[43]

We accept the need to incur capex for the purposes of advance project planning as TransGrid submits. However, we agree with EMCa that TransGrid's repex overspend in the 2014–2018 regulatory control period raises preliminary concerns about its governance processes[44] and we consider that these warrant further review (see below).

There is a further basis for querying the justification of TransGrid's proposed forecast repex. As EMCa noted, network performance metrics such as system minutes, line outages, transformer outages and reactive plant outages have been relatively stable or improving since 2009.[45] This does not support TransGrid's significant increase in forecast repex for the 2014–2018 period.

In relation to this, TransGrid submitted that the age profiles of its assets indicate that the average age of the network is expected to increase slightly over the next five years. It also submitted that the increase in forecast repex is consistent with maintaining the current level of risk.[46] However, TransGrid did not explain how it determines or how it justifies this current level of risk. Nor did it

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39 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 9.

40 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 8.

41 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, pp. 8-9.

42 AER Consumer Challenge Panel, *CCP6 sub panel, Submission on the TransGrid revenue proposal,* 8 August 2014, p. 9.

43 TransGrid, *Response to CCP submission,* September 2014, p. 7

44 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, pp. 8-9.

45 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 12.

46 TransGrid, *Revenue proposal,* May 2014, pp. 94-95.

establish that if the current level of risk was not maintained, how this would adversely impact network reliability and security.[47]

In addition, our assessment of security and compliance expenditure found systemic overestimation in the project risk cost with an estimated bias in the order of at least two if not three orders of magnitude in the expected value of this risk. This casts doubt over TransGrid's current assessment of risk and therefore the forecast requirement for repex.

Our trend analysis therefore does not support the proposed step increase in total repex for the 2014–2018 period.

Engineering/technical assessment

We engaged EMCa to undertake an engineering/technical review of TransGrid's proposed forecast repex in order to:

- identify any systemic issues in the areas of governance and risk management, and forecasting methodology
- if relevant, assess the implications of systemic issues for proposed expenditure taking into account a review of specific projects/programs as nominated by us.

Systemic issues may mean that the forecast is materially higher than would be incurred by a prudent and efficient service provider.

Specifically, EMCa assessed whether:

- TransGrid's proposed forecast repex is a reasonable forecast of the unbiased efficient cost of maintaining performance at the required or efficient service levels
- TransGrid manages risk prudently such that the cost to the customer of achieving the capex objectives at the required or efficient service levels is commensurate with the customer value provided by those service levels
- TransGrid uses the minimum resources reasonably practical to achieve the capex objectives and maintain the required or efficient service levels such that its costs and work practices are prudent and efficient.

EMCa's review focused on four project groupings which account for approximately 67 per cent (or $620 million ($2013–14) of TransGrid's total proposed repex for the 2014-2018 regulatory control period. EMCa's findings are discussed in more detail below. We have used EMCa's assessment to test whether there is evidence of systemic issues leading to a forecasting bias and an overestimation of risk by TransGrid in developing its forecast. We also used EMCa's review in our assessment of the materiality of any systemic issues identified through a review of specific projects/programs.

Review of governance and risk management framework

EMCa undertook a review of TransGrid's governance and risk management, and tested this framework against the capex criteria in the NER.[48] EMCa found that a bias for over estimation of risk

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47 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 19.

48 NER, cl. 6A.6.7(c).

was evident within TransGrid's governance and risk management framework.[49] Below we have set out the material EMCa reviewed and its conclusions.

In its revenue proposal, TransGrid submitted that repex projects are driven by condition risks of assets that are reaching the end of their serviceable lives. TransGrid submitted that it adopts an economic methodology to assess the condition risks of its assets and determine the need for replacement or refurbishment.[50] TransGrid also submitted that projects and programs of work are justified based on technical requirements and cost-benefit evaluation.[51] TransGrid stated that the economic evaluation it uses takes into account the cost of options, with some consideration of future capex and, in some cases, opex.[52]

TransGrid engaged GHD to undertake a review of its network investment plans and supporting documents relevant to identifying project needs, timing and options.[53] GHD's initial review identified that further work should be undertaken on investment planning. TransGrid submitted that upon further review, having taken GHD's advice, GHD considered that TransGrid should be able to demonstrate that its proposed expenditure is prudent and efficient.[54] However, EMCa found that there were substantial gaps in the analysis of the need for a project including the identification and assessment of options, risks, costs and benefits. Further, EMCa did not find sufficient evidence of review and analysis of the overall portfolio to ensure an efficient level of expenditure.[55]

TransGrid's 'Network Investment Risk Assessment Methodology' is a key aspect of its governance framework for undertaking risk assessment for network investment decisions.[56] As EMCa noted, this methodology is linked to TransGrid's corporate risk management framework for undertaking risk assessments and managing identified risks.[57] The methodology ranks investments by the project cost compared to the dollar value of risk reduction.[58] However, EMCa found that TransGrid had not provided evidence as to how the risk is assessed (unit of risk in dollars per annum or total risk cost) at the project level or has been applied in project assessments.[59] Further, EMCa reviewed supporting information regarding the need for projects and found that it was not clear how the derived project risk cost has been used in the assessment and prioritisation of projects.

For example, in assessing substation renewal project risks, TransGrid used the risk assessment matrix reproduced in Figure A-3.

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49 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. ii.

50 TransGrid, *Revenue proposal,* May 2014, p. 69.

51 TransGrid, *Revenue proposal,* May 2014, pp. 87-90.

52 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 21.

53 GHD, *TransGrid, review of network investment plans and supporting documents, Final review report*, May 2014.

54 GHD, *TransGrid, review of network investment plans and supporting documents, Final review report*, May 2014, pp. 8-15.

55 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 11.

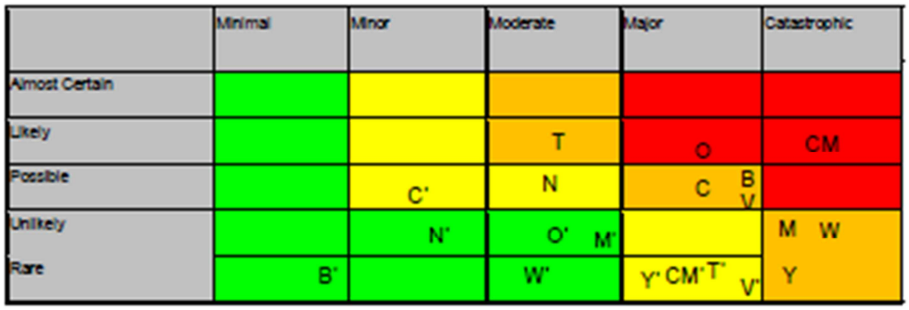
56 TransGrid, *Revenue proposal*, May 2014.

57 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 12.

58 Risk is measured as the likelihood multiplied by the consequence of an asset failure. TransGrid, *Presentation to EMCA and the AER, Practical risk assessment example,* 25 August 2014.

59 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 12.

Figure A-3: TransGrid risk assessment for substation renewal projects before and after treatment



Key	Substation
Y	Yanco
CM	Cooma
B	Burrinjuck
T	Tamworth 132
O	Orange
V	Vales Point
C	Canberra
W	Wagga 132
M	Munmorah
N	Newcastle

Note: Risk categories: Red = Extreme, Orange = High, Yellow = Medium, Green = Low.
Source: TransGrid, Presentation to EMCA and the AER, Practical risk assessment example, 25 August 2014.

This risk assessment aggregates the estimated project risk cost of a project (probability multiplied by consequence of an asset failure) to derive a total risk cost. These risk cost categories concern the safety, environmental, reliability, cost and operational risk-related consequences that may arise from asset failure. In reviewing TransGrid's risk assessments for some proposed substation renewals, EMCa found that the highest risk for all risk categories was lower than when these risks are combined into an overall risk measure.[60]

In summary, EMCa found that the application of TransGrid's risk assessment tools exhibits a strong bias to overstate risk. Specifically:[61]

- the aggregation of these risk cost categories to derive a total risk cost will overstate the estimated risk of a project
- the risk assessments are undertaken at too high a level to identify meaningful risk mitigation actions, which has resulted in unnecessarily large investment projects
- the existence and effectiveness of current risk mitigation controls and management measures has not been included in the risk assessment (e.g. the risk assessment of a number of secondary system renewal projects appeared to be based on the un-mitigated (inherent risk) without consideration of current controls (residual risk)).

At a portfolio level, EMCa did not find evidence of a prioritisation process or framework that considered all business needs and ranked or prioritised those needs based on risk, cost or other criteria. Nor did EMCa find any objective criteria used to identify the economic cut-off for the portfolio of work, or where the prudent risk outcome is achieved for a level of expenditure.[62] Overall, EMCa concluded:[63]

> Our review however identified substantial gaps in the analysis of the need for a project including the identification and assessment of option, risks, costs and benefits. We did not find sufficient evidence of review and analysis of the overall portfolio to ensure an efficient and prudent level of expenditure. Further

60 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 14.
61 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 15.
62 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 17.
63 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 11.

we have found that investment decisions can be based more on an overarching technology driven strategy and implementation goals rather than a disciplined investment decision.

Unit cost forecasting methodology

As part of its proposal, TransGrid submitted a report by Evans and Peck that reviewed its cost estimating system in terms of good industry practice and the likelihood that it will deliver estimates with an equal likelihood of under and over-runs.[64] TransGrid submitted that this report indicates that its estimates are delivering very close to this outcome.[65] TransGrid also engaged Sinclair Knight Merz (SKM) to undertake a review of the reasonableness of its base unit cost data and the operation of its capital estimating database. SKM concluded that TransGrid's unit cost data is reasonable and that its calculation algorithms within its estimating software are functioning correctly and result in accurate project estimates.[66] EMCa did not separately assess the efficiency of TransGrid's unit cost forecasting methodology. On the basis of the information provided to it, EMCa did not consider the cost estimates to be uncompetitive. However, EMCa considered there may be some opportunity to reduce costs further by outsourcing some of the design, site supervision and secondary construction work.[67]

Taking into account the information available to us, we accept the unit cost forecasting methodology. We note EMCa's assessment regarding the possible scope for further efficiencies, but overall consider the unit costs are reasonable.

TransGrid has undertaken a competitive tender process for 96 per cent of its capital program. The estimated database costs have also been based on the cost of competitively sourced work. This has been validated by the capital project cost benchmarking undertaken by UMS Group, SKM, Parsons Brinckerhoff and Aurecon.

Review of proposed replacement expenditure programs

Taking into account the issues identified in TransGrid's governance framework and forecasting methodology, EMCa further assessed a sample of projects related to the following four key proposed programs:

- substation renewal
- secondary system renewal (i.e. metering, protection and control systems)
- communications upgrade and replacement; and
- transmission line life extensions or rebuilds.

The repex for these four programs, which account for the majority of TransGrid's proposed forecast repex, represents a significant increase from the 2009–2014 regulatory control period. This is shown in Figure A-4.

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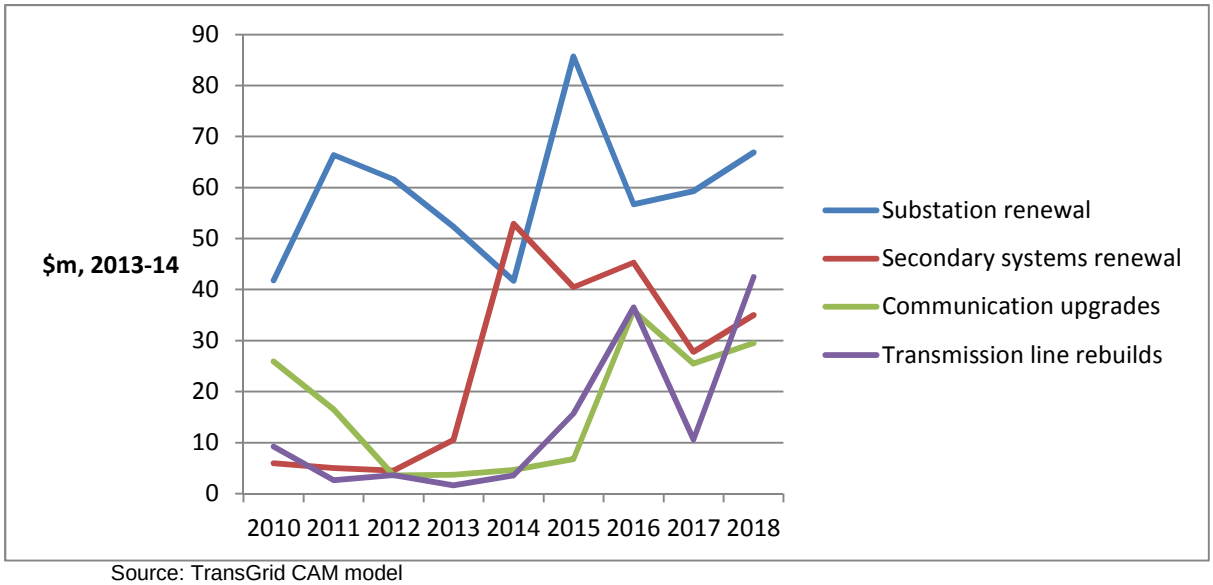
64 Evans & Peck, *TransGrid, Estimating risk assessment, 2014/15 – 2018/19 regulatory submission,* July 2013.
65 TransGrid, *Revenue proposal 2014/15–2018/19,* May 2014, p. 87.
66 Sinclair Knight Merz, *Capital cost estimating review, TransGrid,* March 2014, p. 1.
67 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 23.

Figure A-4: Repex trends for key repex programs, inflation adjusted



Source: TransGrid CAM model

EMCa's assessment of each of the four proposed programs is discussed below.

Substation renewal

TransGrid proposed $268.6 million[68] of repex to renew a number of substations and to commence work on a number of substations in the 2014–2018 period. This is an average annual increase of 27 per cent compared to the 2009–2014 regulatory control period. TransGrid submitted that the scope of renewal comprises the most economically efficient works required to restore the condition of these substations. Depending on the particular condition issues at each substation, the required works may consist of selected plant replacements, in-situ rebuilds or rebuilds on different sites.[69]

EMCa reviewed a number of risk assessments and consistently found evidence of expenditure that was not justified because of an over estimation of the project risk cost. EMCa also reviewed the scope and timing of a sample of substation renewal projects to establish whether there were any substantial issues with the work and whether any of these issues are likely to be systemic. EMCa concluded that:

- in the reviewed sample of projects, the replacement of secondary systems and cables can be reduced in scope
- all of the reviewed projects contain considerable expenditure for replacement or augmentation work in areas such as fencing, drainage, oil containment, auxiliary services and other general civil works which could be deferred.[70]

For example, the risk assessment for the Newcastle substation renewal project requires a cost benefit assessment. However, EMCa found that the outcome of the cost benefit assessment does not support this project being undertaken in the 2014–2018 period, and can therefore be deferred.[71] For similar reasons, EMCa also considered that acting prudently, TransGrid would consider deferring the Wagga 132kV ($51.6 million) and Tamworth 132kV ($43 million) projects as well. EMCa considered

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68 TransGrid, *Capex accumulation model,* May 2014.
69 TransGrid, *Revenue proposal,* May 2014, pp. 72-73.
70 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 27.
71 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 26.

that these projects could be deferred by undertaking temporary works, further utilising assets that have already been replaced, and the purchase/use of a spare transformer.[72]

With a risk cost of $246.54 million per annum, EMCa noted that the Cooma substation is listed as the most extreme risk project. The major risks are associated with the condition of the 11kV regulators and the assumption that it will take up to a year to replace a transformer in the event it fails. EMCa considered that TransGrid significantly overstated the project risk cost given that the redundancy in this substation means that the likelihood of this risk eventuating is low. Based on an assessment of extreme risk, EMCa considered that a new regulator should have already been installed and the removed regulator kept as a spare. Also, the quantified project risk cost identified using TransGrid's methodology implies that a spare transformer should be available, or if not purchased, to cover Cooma and other sub stations as required.[73]

EMCa noted that many of the substation circuit breakers at Cooma have previously been replaced resulting in 65 per cent of the fleet being less than 20 years old. Many of the projects are now being driven by the replacement of other equipment at the substation. However, EMCa considered there is a danger that relatively new circuit breakers will be replaced as part of a substation renewal project. EMCa referred to evidence of this in some of the reviewed projects such as the Wagga 132kV project. This project includes the complete demolition and rebuilding of 132kV switch bays notwithstanding 9 out of 10 circuit breakers are relatively new. EMCa noted that TransGrid's proposal makes no mention of any option to reuse these components.[74]

Overall, EMCa's review found evidence of inadequate risk assessment and forecasting and scope bias. This includes:[75]

- excessive assessment of risk costs
- areas of excessive scope
- insufficient consideration of the option to defer the major renewals by undertaking interim work and the use of spares
- insufficient consideration of the continued use of relatively new assets.

EMCa concluded that it is evident that these issues have led TransGrid to over-estimate its forecast repex for the 2014–2018 period and that these issues are reasonably likely to exist in the remainder of TransGrid's forecast substation renewal repex. EMCa considered that the overestimation of required expenditure is in the order of 10 per cent to 20 per cent and that the level of substation renewal repex during the 2009–2014 regulatory control period is a better indicator of a prudent level of expenditure.[76]

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72 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 27.

73 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, pp. 27-28.

74 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 28.

75 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 28.

76 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 28.

Secondary system renewal

TransGrid proposed $148.6 million[77] of repex relating to its control, metering and protection systems (secondary systems) in the 2014–2018 period. This represents an average annual increase of 135 per cent compared to the 2014–2018 regulatory control period. The secondary system renewal work includes:

- protection – to have the majority of electromechanical relays replaced by 2030 and the discrete component and early microprocessor protection by 2025
- control systems – replace all discrete component control assemblies as a matter of urgency and all early microprocessor type control systems by 2024
- meters – replacement of the remaining electromechanical, solid state and early microprocessor meters by the end of 2014–2018 period.[78]

In EMCa's view TransGrid's strategy for secondary systems renewal results in an aggressive technology driven replacement program. The strategy does not take into account the specific risks associated with each site and instead focusses on target replacement quantities.[79]

In order to assess if there are any systemic issues with the secondary systems renewal repex, EMCa reviewed a sample of projects within this category. The documentation of asset condition, options and options evaluation were sparse. There were no details of specific performance issues associated with the secondary equipment at each site. Instead the number of secondary assets to be replaced at the site is based on technology replacement strategies.[80]

For all of the projects it reviewed, EMCa considered it was not evident that there was a consideration of alternatives to the complete replacement or options to delay the timing of these major projects. EMCa identified that many opportunities exist to use some of the assets being replaced as spares in order to extend the life of schemes at other stations. EMCa noted that TransGrid made no mention of this in the strategies nor did it consider a life extension option.[81]

Overall, EMCa found evidence of forecasting and scope bias including projects that could be reasonably deferred or reduced in scope. As is the case for the substation renewals, EMCa also concluded that it is evident that these issues have led TransGrid to over-estimate its forecast repex for the 2014–2018 period and that these issues are reasonably likely to exist in the remainder of TransGrid's proposed total forecast repex.[82]

Based on its analysis, and the impact of the systemic issues found, EMCa considered that the overestimation of required expenditure is in the order of 20 per cent to 30 per cent and that a reduced level of expenditure is a more reasonable indicator of a prudent level of expenditure for secondary

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77 TransGrid, *Capex accumulation model,* May 2014.

78 TransGrid, *Management system document, Network renewal, maintenance and disposal strategy and objectives - substation automation systems,* 20 May 2014.

79 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 29.

80 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 30.

81 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 31.

82 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 31.

system renewals.[83] EMCa considers that TransGrid can make a reasonable use of life extension strategies and consideration of alternatives to the complete renewal of all secondary systems at the sites.[84]

Communications upgrades

TransGrid has proposed $97.6 million[85] in repex on 11 communications upgrade and replacement projects in the 2014–2018 period. This represents an average annual increase of 124 per cent when compared to the 2009–2014 regulatory control period. TransGrid submitted that its communications network needs to support the communication requirements of the technologies being introduced within the substation environment. Further, many of TransGrid's corporate systems require access from the field.[86]

The largest component of this expenditure category is for TransGrid's Optical Ground Wire (OPGW) strategy. TransGrid's telecommunications network has a number of areas serviced by microwave radio trunk bearer. TransGrid submitted that its current and future bandwidth requirements cannot be adequately serviced by using microwave radio as a trunk bearer. As a result TransGrid has proposed that microwave radio trunk bearers be replaced with OPGW.[87]

The OPGW strategy comprises a total of nine projects with expenditure of $86.7 million[88] for replacing microwave trunk bearers with OPGW in three regions. EMCa acknowledged the strategic benefits of such a program to TransGrid but noted that the case for the proposed expenditure and timing within the 2014–2018 period are not proven.[89]

EMCa considered that the proposed OPGW work has been aggregated at too high a level with a single risk assessment and options analysis, rather than considering the justification of individual projects and associated expenditure. The risks, including risks to supply reliability as a result of congestion and capacity constraints of the existing microwave bearer are not detailed for each project. A single option to implement the OPGW strategy is presented. However, the benefits and significance of timing of the expenditure are not adequately justified. EMCa noted that it did not find sufficient evidence to support the justification of an increase in proposed expenditure for OPGW projects.[90]

TransGrid also proposed to modernise some further communications components to improve performance and to replace obsolete components. Included in the communications forecast is the replacement of a number of components that are reaching the end of expected life and upgrades of communication operation and management systems to mitigate capacity constraints for critical sites.

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83 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 31.

84 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 32.

85 TransGrid, *Capex accumulation model,* May 2014.

86 TransGrid, *Revenue proposal 2014/15–2018/19,* May 2014, pp. 76-77.

87 TransGrid, *Presentation to EMCA and the AER, Telecommunications replacement capital expenditure,* 25 August 2014, slide 2.

88 TransGrid, *Capex accumulation model,* May 2014.

89 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 32.

90 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 32.

EMCa reviewed these items and was satisfied that the proposed work to be undertaken is appropriate.[91]

Overall EMCa's review of a sample of projects identified biases in terms of scope and risk that have led to an overestimate of communications upgrades expenditure in the order of 50 per cent to 60 per cent. EMCa considered that these biases reflect a systemic issue and are reasonably likely to exist in the remainder of this expenditure category. EMCa considered that that this overestimation is likely to be systemic and that the level of communication related repex incurred during the 2009–2014 regulatory control period is a better indicator of a prudent level of expenditure. EMCa further considered that TransGrid can manage this risk through improved and more granular analysis of the benefits and prioritisation of the OPWG projects.[92]

Transmission line rebuilds

TransGrid has proposed $105.3 million[93] in repex for transmission line life extension works. This represents an average annual increase of 536 per cent when compared to the 2009–2014 regulatory control period. TransGrid has assessed the condition of a number of coastal steel tower transmission lines as requiring renewal. TransGrid submitted that corrosion treatment and painting, or in some cases the replacement of towers, is required. TransGrid has also assessed a number of wood pole transmission lines as requiring renewal. TransGrid submitted that these will typically be addressed by replacement of the wood poles with concrete poles while retaining existing conductors, or reconstruction of the transmission line including replacement of conductors.[94]

EMCa considered that the need for proposed refurbishment of steel tower lines is prudent. However it also noted that aspects of the scope of the projects sampled have been engineered conservatively at this initial scoping stage. This means that the cost of the project is higher than necessary as a result of an overly risk averse design. EMCa considered that the risk assessments should include consideration of specific tower conditions and improved justification of the approach to only treat tension towers and prioritisation across the nominated lines.[95] EMCa also considered that the risk assessment should include consideration of a risk based approach to tower treatment across the network.[96]

EMCa supported the need for transmission line wood pole replacement projects. However, EMCa raised the following several concerns with the proposed expenditure:[97]

- the case to rebuild entire lines is not compelling and leads to a high estimate where this is proposed. EMCa considered greater consideration of targeted replacement of individual poles or poles within line sections of the line may lead to a more efficient estimate
- the information provided by TransGrid was insufficient to conclude there was a reasonable expectation of increasing levels of pole defects and an increased risk to reliability of supply.

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91 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 33.

92 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 33.

93 TransGrid, *Capex accumulation model,* May 2014.

94 TransGrid, *Revenue proposal,* May 2014, pp. 74-75.

95 The consequence of failure of a tension tower is higher, which means that the benefit cost assessment of tension tower treatment is different to non-tension towers.

96 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 34.

97 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 34.

EMCa also noted that this is further evidenced by TransGrid stating that the defect rate was manageable

- other risk mitigation options such as pole reinforcement (or nailing) should be considered for application to some lines and line sections, as undertaken by other TNSPs
- whilst it may be efficient to package requirements together within a single project, components to address a low span/clearance requirement and opportunities to install OPGW, where included, need to be justified separately.

Overall in reviewing a sample of TransGrid's proposed transmission line rebuild repex, EMCa noted that there are biases in terms of scope and risk that have led to an overestimate of expenditure. EMCa considered that these biases reflect a systemic issue and are reasonably likely to exist in the remainder of this expenditure category.[98]

Based on its analysis, and the impact of the systemic issues found, EMCa considered that the overestimation of required expenditure is in the order of 10 per cent to 20 per cent and that a reduced level of expenditure is a more reasonable indicator of a prudent level of expenditure. EMCa considered that TransGrid can manage this reduction through prioritisation of projects and can also explore projects and treatments targeted at addressing the identified risk. EMCa considered that TransGrid can manage (the risk) of this reduction through prioritisation of projects and can explore projects and treatments targeted at addressing the identified risk.[99]

Security and compliance

We consider that security and compliance expenditure forms part of repex. TransGrid's proposal included a forecast of $129.6 million[100] for security and compliance related projects for the 2014–2018 regulatory control period. We are not satisfied that the proposed expenditure reasonably reflects the capex criteria. We are satisfied that a forecast of $46.1 million ($real 2013–14) reasonably reflects the requirement for security and compliance capex and have included an allowance for this amount in our alternative estimate of total capex for the 2014–2018 period.

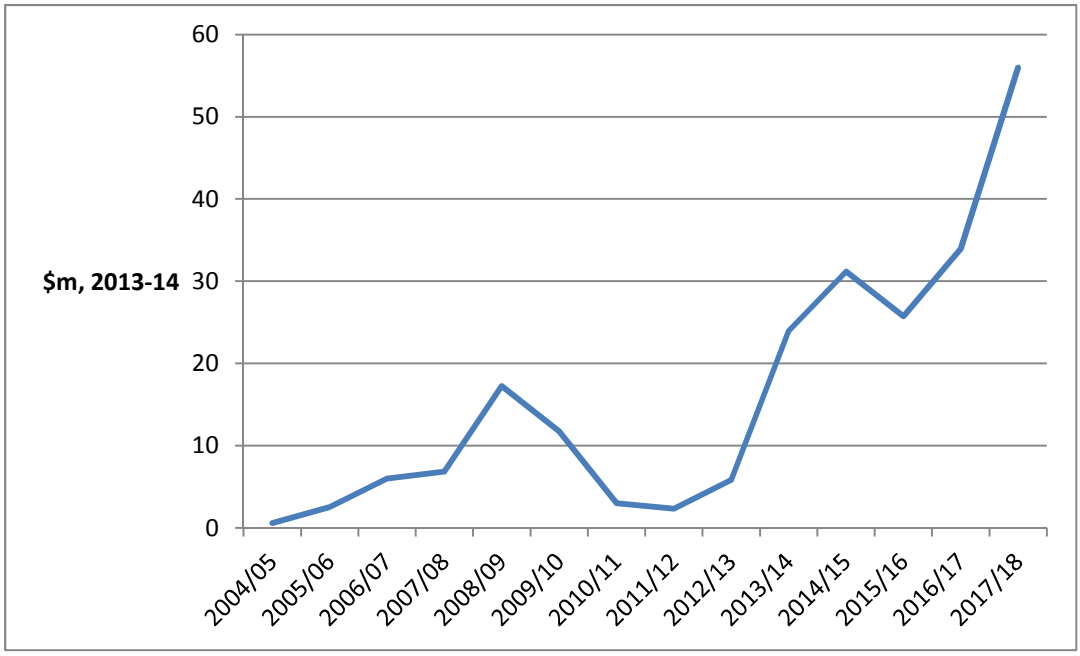
TransGrid's proposed security and compliance capex of $129.6 million for the 2014–2018 period represents an average annual increase of 80 per cent when compared to expenditure in the 2009–2014 regulatory control period. The trend in TransGrid's security and compliance expenditure is shown in Figure A-5.

98 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 34.

99 EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014, p. 34.

100 TransGrid, *Capex accumulation model,* May 2014.

Figure A-5 Trend in TransGrid's security/compliance expenditure



Note: 2013–14 data is an estimate and 2014–15 to 2017–18 is forecast data.
Source: AER analysis.

A breakdown of TransGrid's proposed security and compliance capex is shown in Table A-1. The majority of the proposed increase in this expenditure category is due to a large step increase to rectify transmission line low spans (63 per cent).

Table A-1 TransGrid proposed security/compliance expenditure ($ million 2013–14)

Project grouping	2014–15	2015–16	2016–17	2017–18	Total
Cable remediation	0.1	0.6	3.6	4.9	9.3
Communications	17.6	4.9	0.8	0.0	23.3
Control system	2.5	6.0	0.0	0.0	8.5
Quality of supply	1.0	0.5	1.3	1.3	4.1
Substation minor projects	2.7	0.0	0.0	0.0	2.7
Supply to ACT	0.6	0.0	0.0	0.0	0.6
Transmission line low spans	5.6	11.5	23.9	40.2	81.1
Total security/compliance	**30.1**	**23.6**	**29.6**	**46.4**	**129.6**

Source: TransGrid, Capex accumulation model, May 2014.

Following an Aerial Laser Survey (ALS) TransGrid has identified a number of transmission line spans that do not meet their original design clearances between the transmission line conductors and the ground. TransGrid submitted that it has commenced remedial work on the highest priority

transmission lines to increase the clearances between the conductors and the ground. It has also implemented interim risk management measures on spans on other lines, such as warning signs and installation of access barriers. The forecast capex in the 2014–2018 period includes projects to address low spans on the next priority lines.[101]

In order to form a view as to whether TransGrid's proposed expenditure is likely to reasonably reflect the efficient costs that a prudent operator would require to achieve the capex objectives, we have examined a sample of TransGrid's proposed transmission line low span expenditure. This sample includes $23.5 million (23 per cent) of TransGrid's proposed low span related expenditure. The sample selected includes the following:

- Central Region Pole lines
- Northern Region Tower lines
- Southern Region Tower lines
- Line 992, 993, 97K.

Our analysis and considerations of this sample group is set out below.

Transmission line low spans

Following an ALS a large number of spans across NSW were identified that TransGrid has assessed as being below the minimum ground clearance required by AS7000. In the sample programs reviewed, TransGrid has proposed to spend approximately $37.75 million to address about 890 low spans in two stages across the 2014–2018 and 2019–2024 periods. The first stage of this work is to occur over the 2014–2018 period at a proposed total cost of $23.5 million.

In general, ground clearance is not an absolute and is impacted by a number of variables which will change over time (e.g. power flow, air temperature, land use). Whether or not ground clearance is below standard depends on actual conditions that the line is subject to, as well as assumptions made about these variables during line design and while operating the line. Importantly, the power flow requirements of a line, and how it is operated as part of the overall network and as the energy market varies have a considerable bearing on determining if ground clearance is likely to be below standard. Accordingly, the risk associated with ground clearances is also impacted by these considerations and hence risk varies over time and from span to span as local conditions vary.

TransGrid, based on its ALS, has assessed that 890 spans in the sample reviewed are below the AS7000 ground clearances. The supporting documentation provided by TransGrid exhibits a wide variation of assessed clearance deviations against AS7000 requirements, showing deviations of just over 0.1m to around 3.9m.[102] It is not clear if any of the spans assessed by TransGrid to be below AS7000 ground clearances were built to previous standards that applied at the time of construction. We are not aware of any requirement to retrospectively apply a current standard to an existing line that was built to a different prior standard.

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101 TransGrid, *Revenue proposal,* May 2014, p. 77.

102 TransGrid, *Need statement, Condition of Line 992 (NS-5003),* 10 April 2014; TransGrid, *Need statement, Low spans on Central Region pole lines (NS-0596),* 18 March 2014; TransGrid, *Need statement, Low spans on Northern Region tower lines (NS-0593),* 18 March 2014; TransGrid, *Need statement, Low spans on Southern Region tower lines,* 18 March 2014; TransGrid, *Need statement, Low spans on 97K (Munyang to Cooma) (NS-9007),* 14 March 2014; TransGrid, *Need statement, Remediation of low spans 993 (NS-5005),* 25 March 2014.

We also note that TransGrid has taken action to address the highest priority low spans through the use of relatively low cost measures such as fencing and signage.[103] The program of works proposed for the 2014–2018 period seeks to further remediate the low spans using options such as replacement of conductor attachments, replacement of support structures or modification of support structures. TransGrid's proposed remediation program seeks both to address the remaining lower risk spans and to further remediate the highest risk spans that have been addressed though current actions such as fencing and signage.

Our view is that demonstration of the existence of a compliance driver for the proposed low spans expenditure depends on:

- the reasonableness of TransGrid's analysis of the variables that impact on span clearance
- how the line is operated
- what existing mitigating actions have been taken; and
- what standard the line was built to.

Examination of the information justifying the program expenditure provides limited information to support TransGrid's assessments of non-compliance with a specific obligation or the relevance of the standard applied. Consequently, whether or not there is a compliance issue and the extent of the compliance issue is not demonstrated.

In support of the proposed expenditure TransGrid has provided options assessments.[104] Review of this analysis shows that:

- the "do nothing option" was rejected by TransGrid on the basis that it does not fully reduce the risk to the equivalent level of AS7000
- consideration of other potentially lower cost options such as landscaping, insulated cross arms, conductor re-tensioning, dynamic rating, or de-rating were either dismissed without full consideration, not considered, or deferred until a later stage of the project
- existing actions such as fencing and signage were dismissed by TransGrid as not being permanent solutions and because they do not fully reduce the risk to the equivalent level provided by AS7000
- the options upon which the estimated costs are based are exclusively solutions involving engineering modifications to TransGrid's assets (e.g. replacement of structures).

We consider that TransGrid's options analysis fails to demonstrate the efficiency of the proposed expenditure as required under the NER.[105] TransGrid's approach chooses higher cost solutions while lower cost alternatives are dismissed or not considered. This lack of consideration of lower cost options and the objective to fully eliminate the low span hazard, leads to a bias in the options

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103 TransGrid, *Revenue proposal,* May 2014, p. 77.

104 TransGrid, *Options evaluations report, 992 low spans – Burrinjuck to Tumut (OER-5003),* 20 May 2014; TransGrid, *Options evaluations report, Low spans on Central Region pole lines (OER-0596),* 7 May 2014; TransGrid, *Options evaluations report, Low spans on Northern Region tower lines (OER-0593),* 24 April 2014; TransGrid, *Options evaluations report, Low spans on Southern Region tower lines (OER-0595),* 7 May 2014; TransGrid, *Options evaluations report, 97K low spans (OER-9007),* 28 May 2014; TransGrid, *Options evaluation report, 993 low spans – Wagga Wagga to Gadara (OER-5005),* 24 April 2014.

105 NER, cl. 6A.6.7(c).

selection and hence in the estimated costs. This conclusion is consistent with EMCa's findings in relation to TransGrid's repex, as discussed above.[106]

Risk analysis also informs the value of the chosen options through the assessed residual risk. Table A-3 provides a summary of TransGrid's assessment of the expected annual cost of risk (untreated) for each of the programs in the sample as well as the residual risk upon completion of the proposed program.

Table A-2 TransGrid expected annual cost of risk for sample programs

Low span program	No. of low spans	Total assessed risk (untreated, $m 2013)	Total residual risk ($m, 2013)
Central region pole lines	283	235.71	17.85[A]
Northern region tower lines	218	353.21	17.85
Southern region tower lines	96	353.21	17.85
Line 992, 993, 97K	293	Not provided	Not provided

[A] This value was not available in the documentation provided by TransGrid and has been assumed based on the values for other programs.

Source: TransGrid, *Need statement, Low spans on Central Region pole lines (NS-0596),* 18 March 2014; TransGrid, *Need statement, Low spans on Northern Region tower lines (NS-0593),* 18 March 2014; TransGrid, *Option feasibility request, Remediate low spans on Northern Region tower lines (OFR-0593A),* 7 March 2014; TransGrid, *Need statement, Low spans on Southern Region tower lines,* 18 March 2014; TransGrid, *Option feasibility request, Remediate low spans on Southern Region tower lines (OFR-0597A),* 23 April 2014; TransGrid, *Need statement, Condition of Line 992 (NS-5003),* 10 April 2014; TransGrid, *Need statement, Low spans on 97K (Munyang to Cooma) (NS-9007),* 14 March 2014; TransGrid, *Need statement, Remediation of low spans 993 (NS-5005),* 25 March 2014.

In order to test the reasonableness of these risk findings we reviewed information prepared by Marsh (Marsh report)[107] which was submitted as part of TransGrid's revenue proposal. The Marsh report examines the expected costs associated with TransGrid's overall business risks. This analysis considered a broad range of risks including liability (e.g. bushfire, loss of life), property, towers and lines, industrial special risks (i.e. specific network assets). Amongst other factors, in forming its view of the expected annual cost of funding future losses, the Marsh report considered historical losses as well as 'scenario losses' – that is, losses that TransGrid has historically realised and losses not realised but which could reasonably occur in the future, respectively. The Marsh report found that the annual cost to fund the expected level of future losses was in the order of $3 million for self-insured risks and that the annual cost for commercial insurance was expected to be in the order of $12 million. Importantly, the Marsh report estimates include the risk of asset losses for towers and lines, a category of risk that the Marsh report recommended TransGrid continue to self-insure, noting that other liabilities were costed into the commercial insurance estimates.[108]

While the Marsh report did not consider the costs associated with all risks relevant to TransGrid's investment analysis (i.e. economic risk of loss of supply, reputational damage and market impact), or all factors that contribute to the cost of funding future losses (e.g. the cost of volatility), it did consider the majority of significant risks faced by TransGrid. In noting that the Marsh report estimate reflects the majority of significant risks, it is also important to note that this estimate reflects the risks inherent

[106] EMCa, *Technical review of revenue proposal, Review of proposed replacement capex in TransGrid revenue proposal 2014–2019, Report to Australian Energy Regulator,* 3 October 2014.

[107] Marsh, *TransGrid, Quantification of self-insurance costs and estimation of insurance premiums 2014/2015 to 2018/2019, final*, 14 January 2014.

[108] Marsh, *TransGrid, Quantification of self-insurance costs and estimation of insurance premiums 2014/2015 to 2018/2019, final*, 14 January 2014, pp. 9 & 25-27.

in the assets and practices of TransGrid as they currently stand, and not the risks that could arise if major changes in assets or business operations were made.

From its analysis of the towers and lines loss history recorded in TransGrid's incident register between 2004 and 2013, the Marsh report found that the expected annual cost from historical losses was $392,908 and for 'scenario losses' the expected annual cost to be $90,000. Overall for towers and lines, Marsh estimated the expected annual cost to be $482,908 for the failure of these assets (i.e. not including associated liabilities). These estimates reflect all tower and line hazards both realised as well as conceived of by the Marsh report and TransGrid through the 'scenario loss' analysis, but exclude other risks that are included in other insurance categories (e.g. liability – including bushfire, loss of life, etc.).[109]

To further test TransGrid's assessment of the risk of low spans, we asked TransGrid to provide information relating to realised losses associated with historical low span events since 1990. TransGrid identified one incident in 2006 where a low span may have been a contributing cause and indicated that the cost of this incident was $2,500 excluding the cost to rectify the associated low spans ($130,000). No other realised losses associated with low spans were identified by TransGrid.[110]

The risk associated with low spans has existed for some time (i.e. it is not exclusively a 'scenario' risk). To the extent that TransGrid's assessed annual expected risk is in the order of $200 million to $350 million for each of the programs sampled, we therefore consider that it would be reasonable for TransGrid to have realised some observable portion of these costs. There is, however, no evidence that TransGrid's estimated risk costs have been historically observed.

The Marsh report considered that the expected cost of losses for the towers and lines was $482,908 and recommended that TransGrid continue to self-insure this category of risk. For other risks across TransGrid's overall business operations (e.g. liability, property, industrial special risks) the Marsh report found the expected cost to be to be in the order of $12 million annually.[111] These other risk categories include the liabilities that arise from the low span hazards (e.g. bushfire, loss of life). In its assessment, the Marsh report also accounted for the availability of pass-through provisions under the NER for costs associated with major events.

Given the Marsh report estimates reflect the expected market value of TransGrid's risks and that limited evidence of any significant realised loss history has been demonstrated by TransGrid, we consider that TransGrid's estimate of the cost of low span risk is overstated and that the Marsh report estimate provides a better indication of the likely expected value of risk that TransGrid can expect for its overall business operations. Consequently, we consider that TransGrid's assessment of the annual expected value of the low span risk is overstated by at least two if not three orders of magnitude.

Having examined TransGrid's risk assessment methodology in the context of the Marsh report's analysis, we consider it does not accurately reflect a reasonable range of consequences along with their likelihoods of being realised. This is further compounded by a bias towards overstating event frequency and consequence in the application of this methodology as demonstrated by the low spans example.

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109 Marsh, *TransGrid, Quantification of self-insurance costs and estimation of insurance premiums 2014/2015 to 2018/2019, final*, 14 January 2014, pp. 25-27.

110 TransGrid, *Response to AER information request,* 25 September 2014, pp. 1-2.

111 Marsh, *TransGrid, Quantification of self-insurance costs and estimation of insurance premiums 2014/2015 to 2018/2019, final*, 14 January 2014, p. 9.

As an estimate of the upper limit of low span expenditure, if we assume that the total estimate of approximately $12 million annually in the Marsh report[112] relates solely to the risks associated with the tower and line hazards (including liability), then given TransGrid has about 37,000 spans[113] the present value expected cost of risk per span is around a maximum of $3,000. However as noted above, the Marsh report estimates do not account for other potentially significant risks such as the economic cost of outages or market impact. TransGrid's total annual unserved energy cost is approximately $8.9m (average over 2006–2013),[114] while TransGrid's total market impact is estimated at approximately $200,000 per annum on average.[115] Adding these additional costs to the estimate yields a total present value of the expected cost of risk per span of about $5,700. With approximately 890 low spans targeted for remediation in the sample under review, this provides an upper limit present value estimate of about $5 million. That is, based on this sample, TransGrid is proposing to allocate $37 million to avoid less than $5 million of risk.

Based on our analysis we consider that TransGrid's expenditure to rectify low spans should not exceed $5 million for the sample reviewed. On this basis we estimate that TransGrid's expenditure to rectify low spans should be in the range of 0 to 15 per cent of its proposed expenditure. In order to provide TransGrid with a reasonable opportunity to recover at least its efficient costs as required by the NEL,[116] we have taken the upper end of this range. Accordingly we have reduced TransGrid's proposed security and compliance expenditure relating to low span rectification by 85 per cent.

A.4 AER findings and estimates for strategic property acquisitions

TransGrid forecast capex of $114.7 million ($2013–14) for seven strategic property acquisitions.[117] Strategic property acquisition is the acquisition of land or easements for future use beyond the regulatory control period in which they are acquired. We are not satisfied that TransGrid has accurately forecast the costs or demonstrated the need for all of the proposed acquisitions. As part of our assessment of total capex required for the 2014-18 period, we consider that forecast capex of $10.9 million ($2013–14) is a reasonable estimate of what is required by TransGrid for strategic property acquisitions. We have included this amount in our estimate of total capex for the 2014-18 period.[118]

Figure A-6 shows TransGrid's historical strategic property capex for the period from 2004–05 to 2013–14, and forecast capex for the 2014–18 period.

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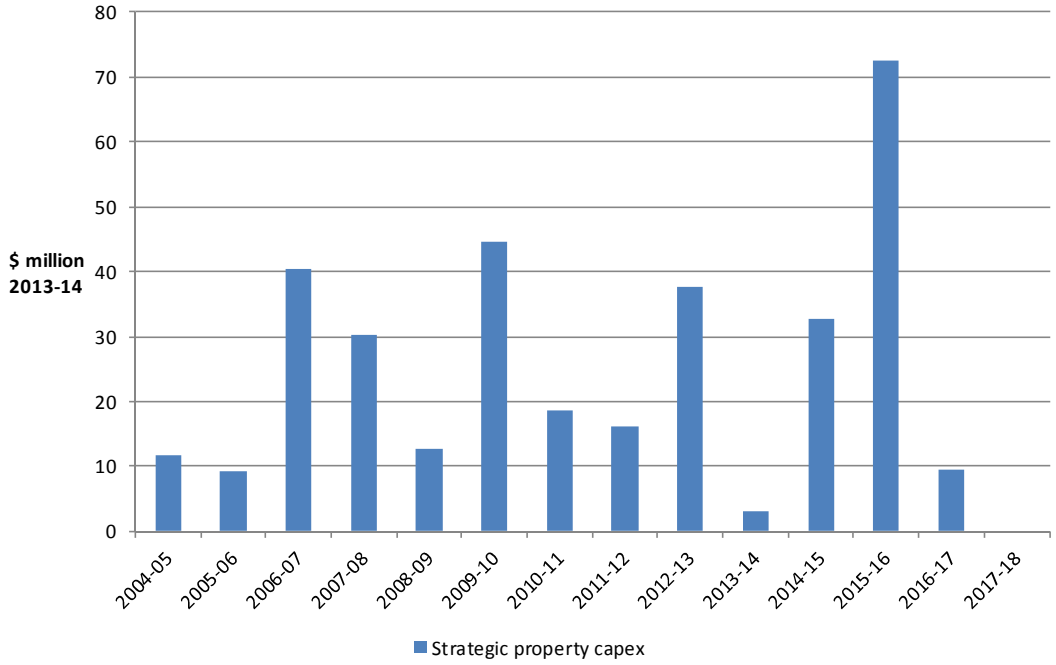
112 Marsh, *TransGrid, Quantification of self-insurance costs and estimation of insurance premiums 2014/2015 to 2018/2019, final*, 14 January 2014, p. 9.
113 TransGrid, *Regulatory information notice templates 2014/15 – 2018/19*, May 2014.
114 This is based on AER analysis of data submitted by TransGrid following information requests from the AER and responses to AER benchmarking RINs.
115 This is based on AER analysis using the average of all market impacted dispatch intervals from 2010 to 2013 and assuming $16/MWh average price impact with a 200MW average dispatch impact. The average number of hours per annum of where the market impact parameter effects market dispatch outcomes is 62 hours (see TransGrid, Economic benchmarking RIN).
116 NEL, s. 7A(2).
117 TransGrid, *Capex accumulation model v3.10*, May 2014.
118 NER, cl. 6A.14.1(2)(ii).

Figure A-6 TransGrid's strategic property capex 2004-05 to 2017-18 ($million, 2013-14)



Source: TransGrid, *Regulatory proposal*, 31 May 2014, pp. 70, 98, 101; AER analysis.

TransGrid's forecast strategic property capex for the 2014–18 period is four per cent lower than actual and expected capex in the 2009–14 regulatory control period, but 10 per cent higher than expenditure in the 2004–09 regulatory control period.[119] Forecast capex is concentrated in the first three years of the 2014–18 period, with a significant spike in expenditure in the 2015–16 year. As can be seen in Figure A-6 strategic property capex requirements are variable from year to year. Individual property acquisitions are driven by the future development needs of the network. However, in a period of low maximum demand growth and limited augmentation requirements, we consider that TransGrid's forecast strategic property capex program warrants further review at the project level to confirm the need and timing for the proposed expenditure.

TransGrid's forecast strategic property acquisitions are set out in Table A-3 below.

[119] NER, cl. 6A.6.7(e)(5).

Table A-3 TransGrid's forecast strategic property capex ($million, 2013-14)

Project name	2014-15	2015-16	2016-17	2017-18	Total
Western Sydney Supply Project	25.2	–	–	–	25.2
Beryl	0.7	–	–	–	0.7
Maraylya	2.3	6.5	–	–	8.7
Surry Hills	–	48.4	–	–	48.4
Richmond Vale	–	2.1	–	–	2.1
Powering Sydney's Future	4.3	13.5	1.7	–	19.5
ACT Easements	0.2	2.2	7.8	–	10.2
Total	**32.6**	**72.6**	**9.5**	**–**	**114.7**

Source: TransGrid, *Capex accumulation model v3.10*, May 2014.

Western Sydney Supply Project

In October 2012, TransGrid compulsorily acquired land needed to complete the Western Sydney Supply project and to allow for future expansion of the Sydney West substation. TransGrid incurred capex of $12.5 million for this acquisition in the 2009–14 regulatory control period, and has proposed further capex of $25.2 million ($2013–14) for final settlement of the acquisition in the 2014-18 period.[120]

In response to a query from the AER, TransGrid advised that the final costs of this acquisition have in fact been accrued in the 2013–14 year.[121] As a result, there is no longer any requirement for this proposed expenditure in the 2014–18 period. We accept that TransGrid's forecast capex for this project should be excluded from our estimate of total capex for the 2014–18 period.

Beryl

TransGrid forecast capex of $0.7 million to acquire a site for future construction of a 330 kV substation near Beryl. TransGrid submitted that the need for the site is driven by a network augmentation requirement forecast to be triggered within the next ten years. The transmission system supplying the existing Beryl 132 kV substation is forecast to reach its thermal limit under contingency conditions in the early 2020s.[122]

Having reviewed TransGrid's need statement, project scoping report and feasibility study for the Beryl augmentation requirement, we are satisfied that TransGrid has justified the need for strategic acquisition of the Beryl site.[123] In particular, we are satisfied that TransGrid has considered a reasonable range of options to address the forecast augmentation requirement, which is likely to be triggered within the next ten years. The proposed timing and costs of the property acquisition appear reasonable given negotiations with land owners are already underway. We are satisfied that TransGrid's proposed capex for this project reasonably reflects the capex criteria in the NER and we will make an allowance for it in our estimate of total capex for the 2014–18 period.

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120 TransGrid, *0412 Sydney West 330kV Switching Station Site Acquisition_Public*, 29 May 2014; TransGrid, *Capex accumulation model v3.10*, May 2014.
121 TransGrid, *Response to AER information request TransGrid Capex 02*, 8 September 2014, p. 11.
122 TransGrid, *Need Statement Continuing - 0705 Beryl 330kV Substation Site - Strategic Property Acquisition*, 28 May 2014.
123 TransGrid, *0705 Beryl 330kV Substation Site Strategic Acquisition_Public*, 28 May 2014.

Maraylya

TransGrid forecast capex of $8.7 million to acquire a site in the Maraylya area for a 500/330 kV substation to address forecast constraints on transmission lines feeding Sydney North. TransGrid has proposed to acquire the land in 2016, to avoid the risk that future land development in the area limits TransGrid's augmentation options to address the forecast constraints by 2029–30. TransGrid submitted that the acquisition process for land in the Maraylya/Hawkesbury region has already commenced.[124] The proposed acquisition was included in TransGrid's annual planning reports for 2013 and 2014.[125]

TransGrid set out the underlying basis for the Maraylya land acquisition in its need statement for this project. This statement considers three scenarios from AEMO's 2013 summer maximum demand forecasts for NSW, representing high, medium and low forecasts for demand growth. The need statement identifies that:[126]

> For the purposes of establishing a need date, the highest growth load forecast has been used….The forecast need date is thus the earliest that an investment could be required.

TransGrid's use of the highest growth demand forecasts is the driver of the identified augmentation need date of 2029–30, and therefore the need to acquire land in advance of this date. However, if AEMO's 2013 medium growth planning scenario forecasts are assumed, the augmentation requirement driving the Maraylya property acquisition is deferred by 11 years to 2040–41.[127] This date would be expected to be further deferred if AEMO's latest 2014 forecasts are applied.[128] TransGrid has also identified that non-network options are expected to be available, and will be used to optimise the timing of the capacity augmentation.[129] If AEMO's 2013 low growth scenario forecasts are assumed, the need for augmentation does not arise within TransGrid's forecasting horizon.[130]

In relation to its 2013 demand forecasting scenarios, AEMO states that it does not consider any one scenario to be more or less likely than another.[131] On this basis, the forecast augmentation requirement identified by TransGrid for 2029–30 is equally likely to occur at a significantly later time.

We are not satisfied that TransGrid's forecast capex for the Maraylya strategic property acquisition reflects a realistic expectation of the demand forecast driving the need for this project.[132] We consider that TransGrid's use of the highest growth load forecast is overly risk averse and as such is not a reasonable basis for planning future network augmentation requirements. When used as a basis for forecasting required capex, such an approach is likely to unnecessarily bring forward and overstate augmentation requirements.

We consider that 'a medium scenario that represents an estimate of how the future may develop given known, well advanced, and anticipated changes to the drivers', as set out by AMEO, is more likely to reflect a realistic expectation of the demand forecast.[133] We consider this to be a realistic expectation of the demand forecast for planning purposes. Applying AEMO's medium growth scenario suggests a possible requirement for network augmentation in the 2040s, at least 11 years later than

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124 TransGrid, *Maraylya 500kV Site - Strategic Property Acquisition Report*, 30 May 2014, p. 4.
125 TransGrid, *NSW Transmission Annual Planning Report 2013*, 28 June 2014, p. 38; TransGrid, *NSW Transmission Annual Planning Report 2014*, 30 June 2014, p. 55.
126 TransGrid, *Need Statement - Strategic Property Acquisition - Maraylya 500kV Site*, 30 May 2014, p. 8.
127 TransGrid, *Need Statement - Strategic Property Acquisition - Maraylya 500kV Site*, 30 May 2014, p. 10.
128 AEMO, *2014 National Electricity Forecasting Report*, 16 June 2014, section 4.2.
129 TransGrid, *Options Evaluation Report - Strategic Property Acquisition - Maraylya 500kV Site*, 30 May 2014, p. 6.
130 TransGrid, *Need Statement - Strategic Property Acquisition - Maraylya 500kV Site*, 30 May 2014, p. 10.
131 AEMO, *2013 Planning Consultation Methodology and Input Assumptions*, 30 May 2013, p. 1.
132 NER, cl. 6A.6.7(c)(3).
133 AEMO, *2014 Planning and Forecasting Scenarios*, 11 February 2014, p. 5.

the need date identified by TransGrid. Even then, the need for this project is subject to considerable uncertainty as it relies on long term forecasts of growth in network maximum demand. It is not prudent to incur significant costs in the 2014–18 period for a project which may or may not be required in approximately 30 years.

For these reasons, we do not accept that TransGrid's forecast capex for this project should be included in our estimate of total capex for the 2014–18 period.

Surry Hills

TransGrid forecast capex of $48.4 million ($2013–14) to acquire a site at Riley Street in Surry Hills, currently owned by Ausgrid, to address the future development needs of the inner city network. The site is intended to provide for the replacement of TransGrid's existing 330/132 kV substation at Haymarket, expected to be required by 2041.[134]

TransGrid submitted that the Haymarket substation cannot be rebuilt on its existing site as the substation is underground, surrounded by medium to high rise buildings, has no adjacent undeveloped land, and is restricted by highly congested cable routes and connections. An alternate bulk supply point for the inner city will therefore need to be established before Haymarket can be retired or replaced.[135] TransGrid submitted that the Surry Hills site has become available on an opportune basis, and is one of the last undeveloped sites in the Sydney inner metropolitan area.[136] TransGrid has considered three options to allow for replacement of the Haymarket substation:

- strategic purchase of the Surry Hills site in 2015
- purchase of the Surry Hills site when required in 2035
- purchase of an alternate site in 2035.[137]

TransGrid submitted that the Surry Hills site currently owned by Ausgrid has certain characteristics which support its strategic acquisition and ongoing use for electricity network purposes, including:[138]

- immediate access to Ausgrid's inner city cable tunnel ring to provide straight forward connection to Ausgrid's current and future zone substations
- tunnel access to TransGrid's existing Haymarket and Beaconsfield 330 kV substations, suitable for direct connection of a 330 kV cable
- relatively short distance to TransGrid's existing Beaconsfield 330 kV substation
- physical size suitable for establishment of a major 330 kV substation and bulk supply point
- suitably located to provide a practical alternative as a replacement for TransGrid's Haymarket 330 kV substation
- suitably located to provide a viable option for relieving forecast constraints in the Ausgrid 132 kV supply network

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134 TransGrid, *0677 Strategic Property Acquisition at Riley Street_Public*, 30 May 2014; TransGrid, *Capex accumulation model v3.10*, May 2014.
135 TransGrid, *0677 Strategic Property Acquisition at Riley Street_Public*, 30 May 2014, pp. 3-4
136 TransGrid, *Regulatory proposal*, 31 May 2014, p. 78.
137 TransGrid, *0677 Strategic Property Acquisition at Riley Street_Public*, 30 May 2014, pp. 8-9.
138 TransGrid, *0677 Strategic Property Acquisition at Riley Street_Public*, 30 May 2014, p. 4.

- unlike many surrounding sites, use of the site by TransGrid is not restricted by heritage listing
- excavation works below street level have already been completed
- minimal acquisition costs compared to a developed site as the site would be purchased directly from Ausgrid undeveloped and with vacant possession.

TransGrid's options analysis identified the acquisition of the Surry Hills site in 2015 as the preferred economic option for the majority of scenarios tested in the business case. This is due to the significantly lower acquisition and demolition costs for undeveloped land in the inner city area, and the higher cabling and tunnel construction costs of an alternative site compared to the Surry Hills site.[139]

TransGrid specifically sought the views of consumers on the proposed strategic acquisition of the Surry Hills site. TransGrid reported some support amongst consumers for maintaining infrastructure in one precinct (adjacent to an existing Ausgrid substation) but also reported concerns regarding the need for the project in the context of moderating energy demand, and current consumers subsidising future consumers.[140] Consumers queried whether the cost impact could be mitigated by an alternative land use earning non-regulated income in the years before it is used. Large users also argued that as the acquisition will benefit consumers in the inner metropolitan area, the costs should be borne by these users when allocating revenue to transmission prices.[141] In response to these concerns, TransGrid noted that a mechanism exists for non-regulated income to offset the cost impact of the acquisition. TransGrid also noted that it is exploring the possibility of making the type of allocation sought by large users under its pricing methodology.[142]

In reviewing this strategic property acquisition, we sought clarification of TransGrid's proposed capex compared to the site valuation prepared by Knight Frank. TransGrid advised of two errors in the value included in its forecast capex relating to a clerical error and the inclusion of GST in the forecast amount, which TransGrid advised overstated the capex requirement by approximately $4.3 million.[143]

We also sought to confirm Ausgrid's intention to dispose of the Surry Hills site in the 2014–18 period. Ausgrid advised that the disposal of the Surry Hills site was not confirmed at the time it submitted its regulatory proposal. Ausgrid has not accounted for the disposal of this site in its regulated asset base for the 2014–19 period.[144] In our view, until such time as Ausgrid confirms its intention to dispose of the Surry Hills site and its anticipated sale proceeds, there is no basis for allowing TransGrid's forecast capex for this acquisition in the 2014–18 period. To accept this aspect of TransGrid's proposed forecast would result in the inclusion of the Surry Hills site as part of the regulated asset base for both Ausgrid and TransGrid, and therefore an over recovery of the cost of this asset from electricity consumers. Further, while the property remains owned by Ausgrid there is no need for TransGrid to acquire the property for strategic reasons to prevent development by a third party. This conclusion will be reviewed if Ausgrid formally clarifies its intention to dispose of the asset in the 2014–18 period.

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139 TransGrid, *0677 Strategic Property Acquisition at Riley Street_Public*, 30 May 2014, pp. 8-9.
140 TransGrid, *Regulatory proposal*, 31 May 2014, p. 104.
141 TransGrid, *Regulatory proposal*, 31 May 2014, p. 104.
142 TransGrid, *Regulatory proposal*, 31 May 2014, p. 104.
143 TransGrid, *Response to AER information request TransGrid Capex 02*, 8 September 2014, p. 10.
144 Ausgrid, *Response to information request AER AUSGRID 033*, 12 September 2014, p. 1; Ausgrid, *Network property plan*, May 2014, pp. 13-18.

For these reasons, we consider that TransGrid's forecast capex for this project should be excluded from our estimate of total capex for the 2014–18 period. We are not satisfied that the forecast capex for this project reasonably reflects the efficient costs required to meet the capex criteria.[145]

Richmond Vale

TransGrid forecast capex of $2.1 million to acquire property adjacent to an existing site at Richmond Vale to provide access from a future 500/330 kV substation to nearby existing line corridors. The need date for the substation development is identified as 2040–41. TransGrid has proposed to acquire the land in 2016 to avoid the risk that future development in the area prevents or otherwise adds to the costs of the preferred network augmentation option.[146]

TransGrid set out the underlying basis for the Richmond Vale land acquisition in its need statement for this project. This statement considers three scenarios from AEMO's 2013 summer maximum demand forecasts for NSW, representing high, medium and low forecasts for demand growth. The need statement identifies that:[147]

> For the purposes of establishing a need date, the highest growth load forecast has been used….The forecast need date is thus the earliest that an investment could be required.

TransGrid's use of the highest growth demand forecasts is the driver of the need date of 2040–41 for the future substation development, and therefore the need to acquire land in advance of this date. However, if AEMO's 2013 medium growth planning scenario forecasts are assumed, the augmentation requirement driving the Richmond Vale property acquisition does not arise in the period covered by TransGrid's forecasts (up to 2053).[148] The augmentation requirement would be further deferred if AEMO's latest 2014 forecasts are applied.[149] TransGrid has also identified that non-network options are expected to be available, and will be used to optimise the timing of the capacity augmentation.[150]

We are not satisfied that TransGrid's forecast capex for the Richmond Vale strategic property acquisition reflects a realistic expectation of the demand forecast driving the need for this project.[151] We consider that TransGrid's use of the highest growth load forecast is overly risk averse and as such is not a reasonable basis for planning future network augmentation requirements. When used as a basis for forecasting required capex, such an approach is likely to unnecessarily bring forward and overstate augmentation requirements.

We consider that 'a medium scenario that represents an estimate of how the future may develop given known, well advanced, and anticipated changes to the drivers', as set out by AMEO, is more likely to reflect a realistic expectation of the demand forecast.[152] We consider this to be a realistic expectation of the demand forecast for planning purposes. Applying AEMO's medium growth scenario suggests the need for network augmentation will not arise within the planning horizon identified by TransGrid. This project is subject to considerable uncertainty as it relies on long term forecasts of growth in network maximum demand. It is not prudent to incur costs in the 2014–18 period for a project which may or may not be required more than 35 years into the future.

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145 NER, cl. 6A.6.7(c)(1).
146 TransGrid, *Richmond Vale 500kV Substation Site - Strategic Property Acquisition Report*, 30 May 2014, pp. 3-10.
147 TransGrid, *Need Statement - Richmond Vale 500kV Substation Site Extension*, 30 May 2014, p. 18.
148 TransGrid, *Need Statement - Richmond Vale 500kV Substation Site Extension*, 30 May 2014, p. 13.
149 AEMO, *2014 National Electricity Forecasting Report*, 16 June 2014, section 4.2.
150 TransGrid, *Options Evaluation Report - Strategic Property Acquisition - Richmond Vale 500kV Substation Site Extension*, 30 May 2014, p. 5.
151 NER, cl. 6A.6.7(c)(3).
152 AEMO, *2014 Planning and Forecasting Scenarios*, 11 February 2014, p. 5.

For these reasons, we do not accept that TransGrid's forecast capex for this project should be included in our estimate of total capex for the 2014–18 period.

Powering Sydney's Future

TransGrid forecast capex of $19.5 million ($2013–14) for a strategic property acquisition and early works associated with the 'Powering Sydney's Future' project. TransGrid proposed the 'Powering Sydney's Future' project as a contingent project for the 2014–18 period. The related strategic property acquisition is proposed for completion in 2017, in advance of TransGrid's forecast need date for the contingent project in 2018–19.[153]

As discussed in Appendix E, we have not allowed TransGrid's proposed 'Powering Sydney's Future' contingent project. Following the receipt of draft updated demand forecasts from Ausgrid, TransGrid advised that a major network solution is unlikely to be required within the 2014–18 period.[154] The updated demand forecasts provided by Ausgrid defer the anticipated timing of the 'Powering Sydney's Future' project by at least three years from the need date identified by TransGrid. We consider that the timing of the related land acquisition project should be similarly deferred. On this basis, the proposed property acquisition is no longer reasonably required within the 2014–18 period.

For these reasons, we are not satisfied that the forecast capex for this project reasonably reflects the efficient costs required to meet the capex criteria.[155] We have excluded it from our estimate of total capex for the 2014–18 period.

ACT Easements

TransGrid has proposed capex of $10.2 million ($2013–14) across the first three years of the 2014–18 period to acquire easements for existing transmission lines in the ACT. TransGrid does not currently have easement rights over its existing transmission lines in the ACT. TransGrid considers that the acquisition of easement rights is necessary to:[156]

- comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services
- maintain the quality, reliability and security of supply of prescribed transmission services
- maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

TransGrid considers the acquisition of easement rights for existing lines will achieve these objectives by:[157]

- securing access to the transmission lines for inspections, maintenance and replacement work
- providing control over activities in proximity to overhead lines to minimise the likelihood of people carrying out activities that may pose safety risks, such as building structures or operating high machinery

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153 TransGrid, *Strategic Property Acquisition Report 0043*, 30 May 2014, p. 3; and TransGrid, *Outline Plan 12 - Supply to Inner Sydney Metropolitan Area and CBD*, May 2014, p. 11.
154 TransGrid, *Sydney inner metropolitan forecasts - adjustments to revenue proposal in light of Ausgrid updated forecasts*, 14 October 2014.
155 NER, cl. 6A.6.7(c)(1).
156 TransGrid, *Need Statement - Easement Acquisitions - ACT*, 23 December 2013, p. 4.
157 TransGrid, *Need Statement - Easement Acquisitions - ACT*, 23 December 2013, p. 5.

- allowing TransGrid to carry out vegetation management to minimise supply interruptions and bushfire ignition risks.

While TransGrid has undertaken a number of projects in the ACT since 2006, it submitted that it has encountered extensive property rights issues highlighting circumstances where, in the absence of property rights, TransGrid could be denied access by a property lease holder. TransGrid submitted that obtaining prior landholder agreement, or pursuing a legal process to obtain access, can be costly and lead to delays in completing necessary work.[158]

In regard to TransGrid's regulatory obligations, *Disallowable Instrument DI2012-267* made under the *Utilities Act 2000* (ACT) has, since 2012, required TransGrid to comply with the ACT Management of Electricity Network Assets Code and Utilities Emergency Planning Code.[159] The ACT Management of Electricity Network Assets Code sets out various duties and obligations, and requires electricity service providers "to protect the integrity and reliability of the electricity network and to ensure the safe management of the electricity network without injury to any person or damage to property and the environment".[160] We consider that TransGrid's proposed acquisition of easement rights is likely to materially assist TransGrid to comply with these obligations.

In summary, we are satisfied that TransGrid's lack of easement property rights in the ACT is likely to lead to inefficiencies in installation and maintenance work in that jurisdiction. A prudent operator would seek to address the public safety and fire start risks associated with TransGrid's inability to prevent building or other activities near existing lines or to undertake vegetation management work as required. The proposed timing and costs appear reasonable, given TransGrid has commenced discussions on the acquisition process with the ACT Government and no impediments to the project have been identified.[161] We are satisfied that TransGrid's proposed capex for this project reasonably reflects the capex criteria in the NER and we will make an allowance for it in our estimate of total capex for the 2014–18 period.

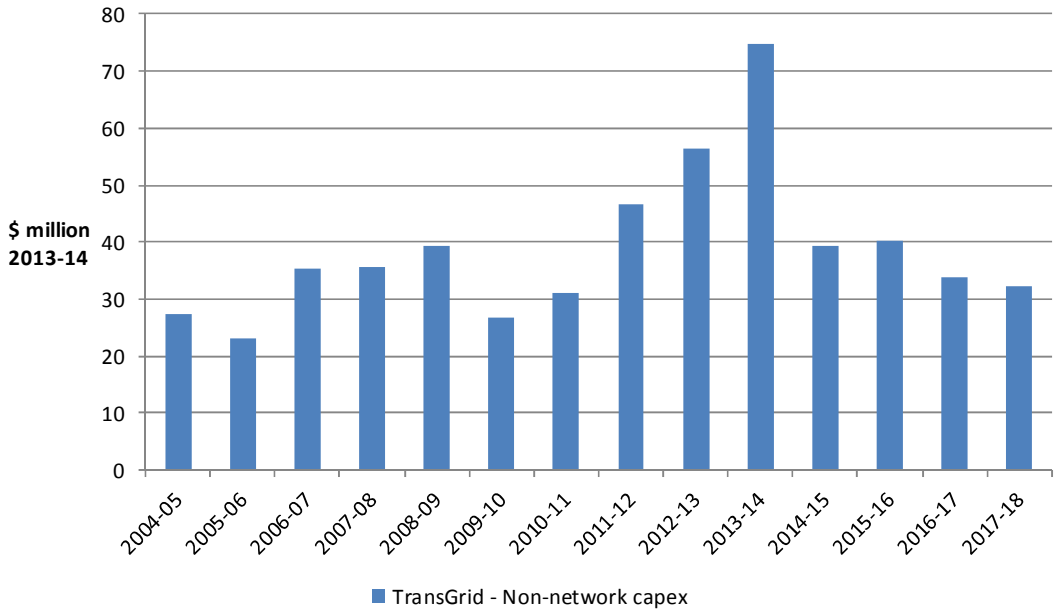
A.5 AER findings and estimates for non-network capex

TransGrid forecast total non-network capex of $145.7 million ($2013-14) for the 2014–2018 period.[162] This includes capex on information and communications technology (ICT), buildings and property, motor vehicles, and other plant and equipment. As part of our assessment of the total capex required for the 2014–2018 period, we accept TransGrid's forecast of non-network capex is a reasonable estimate of the efficient costs required for this capex category. We have included it in our alternative estimate of total capex for the 2014–2018 period.[163]

Figure A-7 shows TransGrid's historical non-network capex for regulatory periods from 2004–05 to 2013–14, and forecast capex for the 2014–2018 period.

158 TransGrid, *Need Statement - Easement Acquisitions - ACT*, 23 December 2013, p. 5; and TransGrid, *Option Feasibility Request - Acquire easements for all existing lines within the ACT*, 14 January 2014, p. 5.
159 *Utilities Exemption 2012 (No 3) - Disallowable Instrument DI2012-267* made under the *Utilities Act 2000*, section 22.
160 *Utilities (Management of Electricity Network Assets Code) Determination 2013 - Disallowable Instrument DI2013–222* made under the *Utilities Act 2000*, section 65.
161 TransGrid, *Response to AER information request TransGrid Capex 02*, 8 September 2014, p. 7.
162 TransGrid, *Regulatory proposal*, May 2014, p. 66.
163 NER, cl. 6A.14.1(2)(ii).

Figure A-7 TransGrid's non-network capex 2004-05 to 2017-18 ($million, 2013-14)



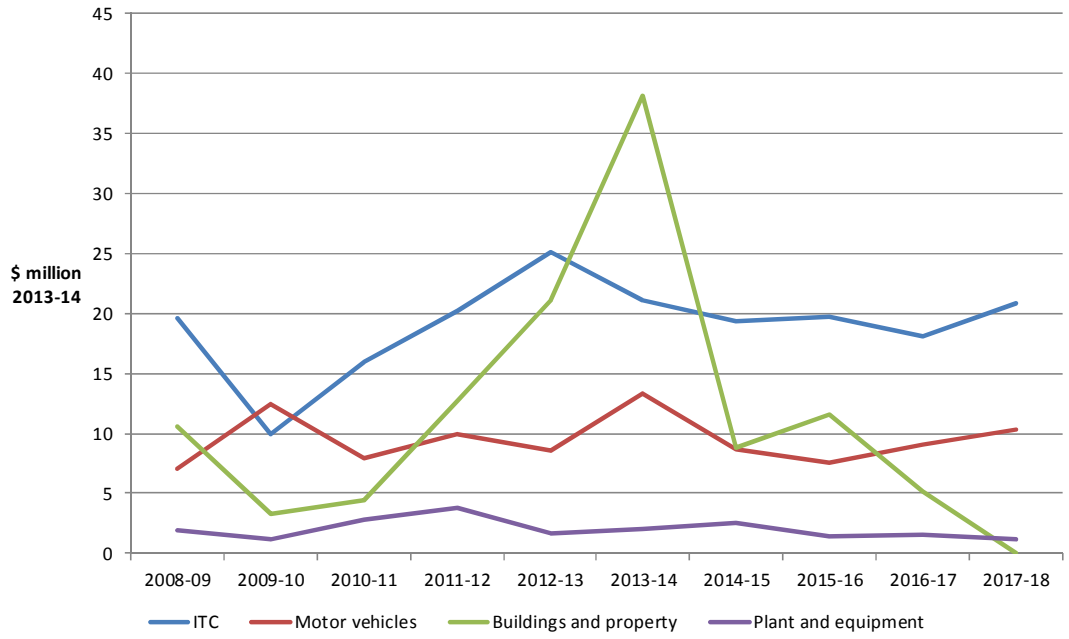
Source: TransGrid, *Regulatory information notice*, template 2.5; TransGrid, *Regulatory proposal*, 31 May 2014, p. 101; AER analysis.

TransGrid's forecast non-network capex for the 2014–2018 period is, on average, 23 per cent lower per year than actual and expected capex in the 2009–2014 regulatory control period. Further, our analysis of longer term trends in non-network capex suggests that TransGrid has forecast capex for this category returning to levels consistent with historical expenditure in this category. Non-network capex for the 2014–2018 period is forecast to be consistent with expenditure in the years from 2006–07 to 2008–09, prior to the spike in investment experienced in the 2009–2014 regulatory control period. This suggests that TransGrid's forecast of non-network capex requirements in the 2014–2018 period is likely to be reasonable having regard to past expenditure.[164]

We have also assessed forecast expenditure in each category of non-network capex. Analysis at this level has been used to inform our view of whether forecast capex is reasonable relative to historical rates of expenditure in each category, and to identify trends in the different category forecasts which may warrant specific investigation.[165] Figure A-8 shows TransGrid's actual and forecast non-network capex by sub-category for the period from 2008–09 to 2017–18.

[164] NER, cl. 6A.6.7(e)(5).
[165] NER, cl. 6A.6.7(e)(5).

Figure A-8 TransGrid's non-network capex by category ($million, 2013-14)



Source: TransGrid, *Regulatory information notice*, template 2.5; AER analysis.

TransGrid has forecast reductions in buildings and property, motor vehicles and plant and equipment capex, while ICT capex is forecast to remain relatively steady in the 2014–2018 period.[166] Forecast capex for each category is stable across the 2014–2018 period, with the exception of buildings and property capex which declines significantly after 2015–16. We sought further information to support TransGrid's forecast of continued investment in ICT assets at the level experienced in the 2009–2014 regulatory control period.[167] TransGrid provided further documentation relating to its ICT asset management, sourcing strategy, and investment business cases.[168] On the basis of this information, and noting that TransGrid's ICT capex is largely recurrent in nature,[169] we are satisfied that the forecast capex is required to meet the capex criteria.[170] Based on our category level review of TransGrid's forecast non-network capex, we have not identified any areas for further specific review at the project or program level. We consider that this level of expenditure reasonably reflects efficient costs.

We have also had regard to whether TransGrid's forecast reduction in non-network capex reflects the substitution possibilities between opex and capex for this category of expenditure, for example undertaking building or motor vehicle maintenance versus replacement.[171] TransGrid's total non-network expenditure per year, across both opex and capex is forecast to decrease by approximately 14 per cent in real terms compared to the 2009–2014 regulatory control period.[172] Taking this into account, we are satisfied that TransGrid's forecast reduction in non-network capex does not simply reflect a reallocation of expenditure from capex to opex.

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166 Changes in forecast capex from the 2009–2014 regulatory control period are measured on the basis of annual average capex due to TransGrid's four year regulatory control period for 2014–2018.
167 AER, *Information request TransGrid Capex 02*, 1 September 2014.
168 TransGrid, *Response to information request TransGrid Capex 02*, 8 September 2014.
169 TransGrid, *Regulatory information notice*, template 2.5 and AER analysis.
170 TransGrid, *Response to AER information request TransGrid Capex 02*, 8 September 2014; and NER, cl. 6A.6.7(c).
171 NER, cl. 6A.6.7(e)(7).
172 TransGrid, *Regulatory information notice*, template 2.5; AER analysis.

In summary, having considered TransGrid's regulatory proposal and had regard to the capex factors[173], we are satisfied that total capex which reasonably reflects the capex criteria should include a forecast of $145.7 million for non-network capex. Our estimate of total capex for the 2014–2018 period reflects this conclusion.

[173] Relevantly, cll. 6A.6.7(e)(5) and 6A.6.7(e)(7).

B Assessment approaches

This appendix discusses the assessment approaches we have applied in assessing TransGrid's proposed forecast capex.

B.1 Economic benchmarking

Economic benchmarking is one of the key outputs of our annual benchmarking report. We are required to consider as it is a capex factor under the NER.[174] Economic benchmarking applies economic theory to measure the efficiency of a TNSP's use of inputs to produce outputs, having regard to environmental factors.[175] It allows us to compare the performance of a TNSP against its own past performance, and the performance of other TNSPs. Economic benchmarking helps us to assess whether a TNSP's capex forecast represents efficient costs.[176] As stated by the AEMC, 'benchmarking is a critical exercise in assessing the efficiency of a NSP'.[177]

A number of economic benchmarks from the annual benchmarking report are relevant to our assessment of capex. These include measures of total cost efficiency and overall capex efficiency. In general, these measures calculate a NSP's efficiency with consideration given to its inputs, outputs and its operating environment. We have considered each TNSP's operating environment insofar as there are factors that are outside of a NSP's control but which affect a NSP's ability to convert inputs into outputs.[178] Once such exogenous factors are taken into account, we expect TNSPs to operate at similar levels of efficiency. One example of an exogenous factor that we have taken into account is customer density. For more on how we have forecast these measures, see our annual benchmarking report.[179]

We have calculated economic benchmarks based on actual data from the previous regulatory control period. We consider these are relevant to determining allowances for the forthcoming regulatory control period as a TNSP's capex and expenditure efficiency in the previous regulatory control period is a good indicator of its likely efficiency in the next regulatory control period. Further, any benchmark efficient level of capex in the previous period will be a useful starting point for setting the efficient level of capex in the upcoming regulatory control period, taking into account any apparent trends.

The results from the economic benchmarking give an indication of the relative efficiency of each of the TNSPs, and how this has changed over time. It indicates the likely range of forecast capex that would be required by an efficient and prudent TNSP taking into account. However, we accept that it is difficult to fully account for exogenous factors particular to each TNSP. To the extent that we are unable to adequately account for exogenous factors, we have factored this into the weighting that we have given our benchmarking, as applied to each TNSP.[180] Also, we have not relied solely on economic benchmarking. It is one technique in a wide range of techniques to assist in forming our view on the reasonableness of a TNSP's proposed forecast and where required, an alternative estimate.

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174 NER, cl. 6A.6.7(e)(4).
175 AER, *Explanatory Statement: Expenditure Forecasting Assessment Guidelines*, November 2013.
176 NER, cl. 6A.6.7(c)
177 AEMC, *National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, November 2012, p. 25.
178 See AEMC, *National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, November 2012, p.113. Exogenous factors could include geographic factors, customer factors, network factors and jurisdictional factors.
179 AER, *Annual Benchmarking Report*, 2014.
180 AEMC, *National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, November 2012, p. 113.

B.2 Trend analysis

We have considered past trends in actual and forecast capex. This is one of the capex factors that we are required to have regard to.[181]

Trend analysis involves comparing NSPs' forecast capex and work volumes against historic levels. Where forecast capex and volumes are materially different to historic levels, we have sought to understand what has caused these differences. In doing so, we have considered the reasons given by the TNSPs in their proposals, as well as changes in the circumstances of the TNSP.

In considering whether a business' capex forecast reasonably reflects the capex criteria, we need to consider whether the forecast will allow the business to meet expected demand, and comply with relevant regulatory obligations.[182] Demand and regulatory obligations (specifically, service standards) are key drivers of capex. More onerous standards will increase capex, as will growth in maximum demand. Conversely, reduced service obligations or a decline in demand will likely cause a reduction in the amount of capex required by a TNSP.

Maximum demand is a key driver of augmentation or demand driven expenditure. As augmentation often needs to occur prior to demand growth being realised, forecast rather than actual demand is relevant when a business is deciding what augmentation projects will be required in an upcoming regulatory control period. However, to the extent that actual demand differs from forecast, a business should reassess the need for the projects. Growth in a business' network will also drive augmentation and connections related capex. For these reasons it is important to consider how trends in capex (and in particular, augex and connections) compare with trends in demand (both maximum demand and customer numbers).

For service standards, there is generally a lag between when capex is undertaken (or not) and when the service improves (or declines). This is important in considering the expected impact of an increase or decrease in capex on service levels. It is also relevant to consider when service standards have changed and how this has affected a NSP's capex requirements.

We have looked at trends in capex across a range of levels including at the total capex level, for growth related capex, for replacement capex, and for each of the categories of capex, as relevant. We have also compared these with trends in demand and changes in service standards over time.

B.3 Engineering review

We have engaged engineering consultants to assist with our review of TransGrid's' capex proposals. This has involved reviewing TransGrid's processes, and specific projects and programs of work.

In particular, in respect of augex and repex, we have engaged engineers to consider whether TransGrid's:

- Forecast is reasonable and unbiased, by assessing whether the TNSP’s proposed capex is a reasonable forecast of the unbiased efficient cost of maintaining performance at the required or efficient service levels.

[181] NER, cl. 6A.6.7(e)(5).
[182] NER, cl. 6A.6.7(a)(3).

- Risk management is prudent and efficient, by assessing whether the business manages risk such that the cost to the customer of achieving the capex objectives at the required or efficient service levels is commensurate with the customer value provided by those service levels.
- Costs and work practices are prudent and efficient, by assessing whether the TNSP uses the minimum resources reasonably practical to achieve the capex objectives and maintain the required or efficient service levels.

We have considered these factors as they relate directly to our assessment of whether the TNSP's proposal reflects the efficient costs that a prudent operator would require to achieve the capex objectives:[183]

- If a capex forecast is reasonable and unbiased, the forecast should reflect the efficient costs required to meet the capex objectives. That is, there should be no systemic biases which result in a forecast that is greater than or less than the efficient forecast. Further, the forecast should be reasonable in that it reflects what a prudent operator would incur to achieve the capex objectives.
- If the TransGrid's risk management is prudent and efficient, TransGrid's forecast is likely to reflect the costs that a prudent operator would require to achieve the capex objectives. A prudent operator would consider both the probability of a risk eventuating and the impact of the risk (if it were to occur) in determining whether to undertake work to mitigate the risk.[184]
- If TransGrid's costs and work practices are prudent and efficient, TransGrid will have the appropriate governance and asset management practices to ensure that TransGrid has determined an efficient capex forecast that is based on a realistic expectation of the demand forecast and cost inputs required to achieve the capex objectives.

Accordingly, the engineering review was tasked with assessing whether there were any systemic issues arising from TransGrid's governance and risk assessment framework and whether there is evidence that indicates that the forecasts are biased. The engineering reviews focused on TransGrid's major replacement programs and adopted a sampling approach in considering the above factors. Where this revealed concerns about systemic issues, we asked the engineers to quantify the likely impact of these biases. This review covered an assessment of:

- the options the NSP investigated to address the economic requirement (for example, for repex projects the review included an assessment of the extent to which the NSP considered sub options for replacements)
- whether the timing of the project is efficient and prudent (including replacement strategies at a portfolio level)
- unit costs and volumes, including comparisons with past trends in expenditure
- longer term asset replacement strategies (including replacement strategies at a portfolio level rather than at a project level)
- the relative prices of operating and capital inputs and the substitution possibilities between operating and capital expenditure

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183 NER, s. 6.5.7(c) (version 58).

184 This approach is supported by NERA Economic Consulting, see NERA, Economic Interpretation of Clauses 6.5.6 and 6.5.7 of the National Electricity Rules, Supplementary Report, Ausgrid submission, 8 May 2014, p. 7.

- the extent to which the capex forecast includes expenditure to address the concerns of electricity consumers as identified by the TNSP in the course of its engagement with electricity consumers. This is most relevant to core network expenditure (augex and repex) and may include the NSP's consideration of the value of customer reliability (VCR) standard or a similar appropriate standard.

In some cases we have also reviewed specific capex projects or programs of work to determine whether these meet the capex criteria. These reviews have been undertaken in respect of particular capex categories related to proposed asset replacement expenditure.

C Demand

This appendix sets out our observations of demand trends in TransGrid's network for the 2014–2018 period.[185]

Demand forecasts are fundamental to a NSP's forecast capex and opex, and to the AER's assessment of that forecast expenditure.[186] TransGrid must deliver electricity to its customers and build, operate and maintain its network to manage expected changes in demand for electricity. When TransGrid invests in its network to meet demand and increases in electricity consumption, it incurs capex. In particular, the expected growth in demand is an important factor driving network augmentation expenditure and connections expenditure (growth capex).[187] TransGrid uses demand forecasts in conjunction with network planning to determine the amount and timing of such expenditure. TransGrid also incurs opex in relation to the new assets it builds to meet demand.

System demand represents total demand in the TransGrid transmission network. This attachment considers demand forecasts in TransGrid's network at the system level. These observations give an indication of overall demand trends and for the first time include a comparison to AEMO's independent demand forecasts. System demand trends give a high level indication of the need for expenditure on the network to meet changes in demand. Forecasts of increasing system demand generally signal an increased requirement for growth capex, and converse for forecasts of stagnant or falling system demand.[188] Accurate, or at least unbiased, demand forecasts are important inputs to ensuring efficient levels of investment in the network. For example, overly high demand forecasts may lead to inefficient expenditure as NSPs install unnecessary capacity in the network.

However, localised demand growth (spatial demand) drives the requirement for specific growth projects or programs. Spatial demand growth is not uniform across the entire network: for example, future demand trends would differ between established suburbs and new residential developments. Accordingly, there is also a need to consider spatial demand forecasts as part of determining the requirement for growth capex for the 2014–2018 period. AEMO undertook this assessment of spatial demand forecasts in relation to TransGrid's proposed projects. Section A.1 discusses this analysis in more detail.

C.1 AER position on system demand trends

We are satisfied the system demand forecasts in TransGrid's regulatory proposal for the 2014–2018 period reasonably reflects a realistic expectation of demand.[189] These forecasts are considerably lower than previous forecasts. Indeed, TransGrid has progressively downgraded its demand forecasts in its annual planning reports since its regulatory proposal for the 2009–2014 regulatory control period.[190] As we would expect, one result of this trend is the significant reduction in TransGrid's augex forecast for the 2014–2018 period compared to the 2009–2014 regulatory control period (see section A.1).

However, we understand the NSPs are in the process of further updating their demand forecasts. We consider the forecasts in our decisions should reflect the most current expectations of the forecast

185 In this attachment, 'demand' refers to summer maximum, or peak, demand (megawatts, MW) unless otherwise indicated.
186 NER, clauses 6A.6.6(c)(3) and 6A.6.7(c)(3).
187 Section A.1 and A.2 discuss our consideration of TransGrid's augex and connections expenditure.
188 Other factors, such as network utilisation, are also important high level indicators of growth capex requirements.
189 NER, clauses 6A.6.6(c)(3) and 6A.6.7(c)(3).
190 TransGrid, *Revenue proposal: 2014/15 – 2018/19*, May 2014, p. 32.

period. Hence, we will consider updated demand forecasts and other information in the final decision to reflect the most up to date data.

For example, Ausgrid, who is connected to TransGrid's network, provided updated non-coincident demand forecasts for each its zone substations and subtransmission substations. Compared to the forecasts it used in its regulatory proposal, Ausgrid forecasted lower demand for the majority of substations in the updated forecasts.[191] All else being equal, this suggests TransGrid's updated system demand forecast would also be lower.[192] Hence, there is evidence a lower system demand forecast (compared to TransGrid's proposal) may also reflect a realistic expectation of demand.[193] We would expect a downward revision of TransGrid's expenditure forecast with a downward revision in the demand forecast (noting spatial demand is the main driver for growth capex).

The Australian Energy Market Operator (AEMO) forecasted similar trends of low system demand growth for the NSW region as TransGrid.

Submissions from stakeholders suggest there is evidence demand will continue to stagnate, or even fall, in TransGrid's network for the 2014–2018 period. We note stakeholders generally provided qualitative evidence, and did not suggest specific demand figures.

Section C.3 discusses these observations in more detail.

C.2 AER approach

Our consideration of demand trends in TransGrid's network relied primarily on comparing demand information from the following sources:

- TransGrid's regulatory proposal
- forecasts from AEMO
- stakeholder submissions in response to TransGrid's regulatory proposal (as well as submissions made in relation to the NSW/ACT distribution determinations more generally).

TransGrid's proposal

In its regulatory proposal, TransGrid stated it relied on the following sources of demand forecasts as inputs to its capex forecast:

- AEMO's 2013 National Electricity Forecasting Report (2013 NEFR) for the NSW region
- Connection point (CP) demand forecasts from the NSW and ACT DNSPs.[194]

TransGrid provided demand forecasts for its network in the reset RIN.[195] TransGrid stated it based the system demand forecasts in the reset RIN on the 2013 NEFR forecasts.[196] We note AEMO

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191 AER analysis; Ausgrid, *Ausgrid's response to the AER's information request of 26 September 2014: Attachment: P50 2013 2014 Development forecast all zones.xlsx*, 2 October 2014.

192 TransGrid's system demand forecast may remain the same (or even increase) if areas with increased demand forecasts at least offset areas with lower forecasts.

193 NER, cll.6A.6.6(c)(3) and 6A.6.7(c)(3).

194 TransGrid, *Revenue proposal*, May 2014, p.110.

195 TransGrid, reset RIN.

196 TransGrid, *RIN response: Section 6: Demand forecast*, May 2014, p. 1.

downgraded its demand forecasts for the NSW region in its most recent report, the 2014 NEFR (see below).[197]

AEMO forecasts

AEMO has published the NEFR since 2012, and published the latest edition in June 2014 (2014 NEFR).[198] The NEFR includes AEMO's summer and winter demand forecasts for all regions of the National Electricity Market.

In July 2014, AEMO published the first edition of transmission CP forecasts for New South Wales and Tasmania.[199] These forecasts are AEMO's independent electricity maximum demand forecasts at transmission CP, over a 10-year outlook period.[200] The Standing Council on Energy Resources (SCER) intended these demand forecasts to inform our regulatory determinations.[201]

AEMO described the key steps to its CP forecasting methodology as:

- data preparation (including demand and weather data)
- weather normalisation
- determination of starting point
- determination of growth rate
- determination of baseline forecasts (application of growth rate to the starting point)
- adjust for rooftop photovoltaics and energy efficiency
- reconciliation of CP forecasts with the relevant state forecast from the 2014 NEFR.[202]

As part of our consideration of system demand forecasts, we compared TransGrid's system demand forecast to the sum of AEMO's CP forecasts for TransGrid's network. We undertook further investigation to understand TransGrid's demand forecasts where they differed significantly from AEMO's CP forecasts. This included making enquiries of TransGrid and AEMO to determine any differences in the composition of the datasets they each used and to ascertain the reasons for discrepancies.

We also compared TransGrid's system demand forecast to the NSW demand forecasts in the 2014 NEFR. We used the 2014 NEFR as a high level check, but focused on the comparison with the AEMO's CP demand figures because they are AEMO's latest forecasts.

Section C.3 sets out our comparisons of AEMO's CP forecasts with TransGrid's demand forecasts, and takes into account stakeholder submissions.

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197 AEMO, *National electricity forecasting report for the National Electricity Market*, June 2014, p. 4-4.
198 AEMO, *National electricity forecasting report for the National Electricity Market*, June 2014.
199 AEMO, *Transmission connection point forecasting report for New South Wales and Tasmania*, July 2014, p. 6.
200 AEMO, Website: /www.aemo.com.au/Electricity/Planning/Forecasting/Connection-Point-Forecasting/Transmission-Connection-Point-Forecasts, accessed 3 September 2014.
201 AER, *Better regulation: Explanatory statement: Expenditure forecast assessment guideline*, November 2013, p. 182.
202 AEMO, *Transmission connection point forecasting report for New South Wales and Tasmania*, July 2014, pp. 7–8; AEMO, *Connection point forecasting: A nationally consistent methodology for forecasting maximum electricity demand*, 26 June 2014.

C.3 AER considerations on system demand trends

The demand forecasts in TransGrid's regulatory proposal for the 2014–2018 period are considerably lower than previous demand forecasts. TransGrid progressively downgraded its demand forecasts since its regulatory proposal for the 2009–2014 regulatory control period.[203] For example, TransGrid's regulatory proposal demand forecasts for the 2014–2018 period are, on average, 3060MW (or 18.8 per cent) lower than its 2011 Annual Planning Report demand forecasts.[204] We note TransGrid 's forecast demand growth rates displayed a similar trend to AEMO's forecasts, although the absolute values of TransGrid's demand forecasts are higher than AEMO's forecasts.

There is also some evidence which shows demand may stagnate, or even continue to fall in the 2014–2018 period. For example, several stakeholders raised concerns that TransGrid, as well as the NSW/ACT DNSPs, are still using overly conservative demand forecasts as inputs to their regulatory proposals. We note stakeholders generally provided qualitative evidence, and did not suggest specific demand figures.

Figure C-1 shows our comparison between TransGrid's system demand and AEMO's CP demand for the NSW region.[205] It shows the growth trend for TransGrid's system demand forecast is consistent with AEMO's CP forecasts for the 2014–2018 period. This is despite having different datasets and forecasting approaches (see below). This gives us a level of confidence the trend in TransGrid's forecasts are realistic.

Figure C-1 also indicates there are differences in TransGrid's and AEMO's historical data, particularly for 2008–09. In addition, TransGrid's forecasts are consistently higher than AEMO's forecasts at both 10 and 50 per cent probability of exceedance (PoE).

We liaised with TransGrid and with AEMO to ascertain the reasons for the discrepancies. We also asked TransGrid whether they would adjust their demand forecast to match AEMO's CP forecasts given the latter are the latest available forecasts.[206]

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203 TransGrid, *Revenue proposal*, May 2014, p. 32.

204 TransGrid, *Transmission annual planning report 2013*, 28 June 2013, p. 29; TransGrid, *Transmission annual planning report 2011*, I July 2011, p. 37.

205 We summed AEMO's coincident demand figures for each CP in TransGrid's network for each year.

206 AER, *Email to TransGrid: AER TransGrid - Demand 02 - maximum demand*, 20 August 2014.

Figure C-1 Comparison of TransGrid demand and AEMO CP demand

Source: TransGrid reset RIN; AEMO, *Dynamic interface for connection points in New South Wales and Tasmania*, 31 July 2014.

TransGrid noted several differences between its demand data and AEMO's CP demand data. For example, AEMO's forecasts are for the NSW region of the NEM, whereas TransGrid's forecasts are for its network, which extends into the Victoria region. TransGrid also considered its demand figures differ from AEMO's in the way they treat interconnectors and pumping loads.[207]

In addition, TransGrid noted the AEMO historical MD in Figure C-1 differs significantly from the NSW regional demand in the 2014 NEFR. In particular, TransGrid stated the figures in the years prior to 2009–10 appear unrealistic.[208]

TransGrid did not propose to adopt AEMO's CP demand forecasts as an input to its regulatory proposal. TransGrid considered the CP demand forecasts the NSW/ACT DNSPs provided contain the relevant local knowledge pertaining to each CP, and hence are the more suitable inputs to expenditure forecasts.[209]

AEMO acknowledged the factors TransGrid identified explain some of the differences between its dataset and those of TransGrid. AEMO also noted TransGrid did not raise the treatment of rooftop photovoltaics, energy efficiency and large industrial customer activity in its response. AEMO expected different handling of these issues would result in differences in the datasets and demand forecasts.[210]

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207 TransGrid, *Response to AER: AER TransGrid - Demand 02 - maximum demand*, 27 August 2014, p. 3.
208 TransGrid, *Response to AER: AER TransGrid - Demand 02 - maximum demand*, 27 August 2014, p. 2.
209 TransGrid, *Response to AER: AER TransGrid - Demand 02 - maximum demand*, 27 August 2014, pp. 1 and 5.
210 AEMO, *AEMO review: AEMO/NSP transmission connection point forecast comparison: For New South Wales (incl. ACT)*, October 2014, p. 1.

We are satisfied TransGrid's responses adequately explain at least some of the differences between its demand figures and those of AEMO.

We note AEMO reconciled the transmission CP forecasts with its NSW regional forecasts, which we noted earlier does not exactly correspond with TransGrid's network. We understand AEMO has begun consultation with TransGrid in reconciling their datasets.[211] We anticipate this process will result in more comparable datasets in future regulatory determinations.

While TransGrid and AEMO forecasted slow demand growth for the TransGrid network, there is evidence demand growth may be stagnant, or even negative in the 2014–2018 period.

Several stakeholders raised concerns that TransGrid, as well as the NSW/ACT DNSPs, are still using overly conservative demand forecasts as inputs to their regulatory proposals. For example, the Energy Users Association of Australia (EUAA) noted TransGrid's 10 per cent POE demand forecast will only be slightly above actual demand in 2006–07.[212] Similarly, Norske Skog noted the 2014 NEFR forecast at 10 per cent POE will not exceed the highest recorded NSW demand (which occurred in February 2011) until 2020–21.[213]

PIAC noted the growing disjunction between GDP and energy use, pointing to a decline in energy intensity.[214] PIAC considers the factors contributing to the decline in energy usage—such as high electricity prices, the growth of solar installations and energy efficiency initiatives—will continue.[215] To the extent this reduction is now 'built in' to NSW customers, coupled with the decline in energy intensive industry, PIAC considers it is unlikely there will be recovery in energy demand.[216] A joint submission from electricity generators supported this stating demand is falling due to factors such as increased energy efficient appliances and increased customer awareness.[217] The Australia Institute also noted changes to behaviour and energy efficiency, and structural changes to the economy (such as the move from manufacturing to services, which are less energy-intensive).[218]

The Australia Institute noted the relationship between seasonal demand and weather appears to have changed much less (than the relationship between weather and electricity consumption). The Australia Institute expected demand to gradually increase with a growing population.[219] AEMO also forecast positive, albeit low, demand growth rates for the 2014–2018 period (see Figure C-1), with population growth and a positive economic outlook being the primary drivers.[220]

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211 AEMO, *AEMO review: AEMO/NSP transmission connection point forecast comparison: For New South Wales (incl. ACT)*, October 2014, p. 8.

212 EUAA, *Submission on TransGrid's revenue proposal 2014–2018*, 8 August 2014, p. 6.

213 Norske Skog, *NSW electricity transmission revenue reset: Norske Skog Albury Mill's response to TransGrid's application*, 8 August 2014, pp. 6–7.

214 PIAC, *Moving to a new paradigm: submission to the Australian Energy Regulator's NSW electricity distribution network price determination*, 8 August 2014, p. 40.

215 PIAC, *Moving to a new paradigm: submission to the Australian Energy Regulator's NSW electricity distribution network price determination*, 8 August 2014, pp. 40–41.

216 PIAC, *Moving to a new paradigm: submission to the Australian Energy Regulator's NSW electricity distribution network price determination*, 8 August 2014, p. 35.

217 Electricity generators, Joint submission on TransGrid's revenue proposal, 8 August 2014, p. 2.

218 The Australia Institute, *Power Down: Why is electricity consumption decreasing?: Institute paper no. 14*, December 2013, pp. 59–66.

219 The Australia Institute, *Power Down: Why is electricity consumption decreasing?: Institute paper no. 14*, December 2013, p. 56.

220 AEMO, *Transmission connection point forecasting report for New South Wales and Tasmania*, July 2014, p. 1.

C.3.1 Past forecasting inaccuracies

The CCP noted the demand forecasts TransGrid used to justify its capex forecast for the 2009–2014 regulatory control period proved to be 'dramatically overblown'.[221]

We acknowledge demand forecasting is not a precise science and will inevitably contain errors. However, consistent over-forecasting, as the submission above noted, may indicate a systemic bias in a NSP's demand forecasting approach.[222] As we discussed above, our analysis indicates TransGrid's demand forecasts exhibit growth patterns consistent with AEMO's. However, we will monitor the accuracy of TransGrid's demand forecasts in future regulatory years to check for any indications of bias. This in turn would aid in monitoring potentially inefficient expenditure levels in the network.

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221 CCP, *AER consumer challenge panel (CCP6 sub panel): Submission on the TransGrid Revenue proposal*, 8 August 2014, p. 8.

222 AER, *Better regulation: Explanatory statement: Expenditure forecast assessment guideline*, November 2013, p. 176.

D Real cost escalation

Real material cost escalation is a method for accounting for expected changes in the costs of key material inputs to forecast capex. The materials input cost model submitted by TransGrid includes forecasts for changes in the prices of commodities such as copper, aluminium, steel and crude oil, rather than the prices of intermediate outputs themselves (e.g., poles, cables, transformers) which are the inputs directly sourced by TransGrid in the provision of its network services. TransGrid has also escalated construction costs and land in its materials input cost model.

D.1 Position

We are not satisfied that TransGrid's proposed real material cost escalators (leading to cost increases above CPI) which form part of its total forecast capex reasonably reflect a realistic expectation of the cost inputs required to achieve the capex objectives over the 2014–19 period.[223] Instead we consider that zero per cent real cost escalation is reasonably likely to reflect the capex criteria is likely to reasonably reflect a realistic expectation of the cost inputs required to achieve the capex objectives over the 2014–19 period. We have arrived at this conclusion on the basis that:

- the degree of the potential inaccuracy of commodities forecasts is such that we consider that zero per cent real cost escalation is likely to provide a more reliable estimation for the price of input materials used by TransGrid to provide network services
- there is little evidence to support how accurately TransGrid's input cost model forecasts reasonably reflect changes in prices paid by TransGrid for physical assets in the past and by which we can assess the reliability and accuracy of its forecast materials model. Without this supporting evidence, it is difficult to assess the accuracy and reliability of TransGrid's material input cost escalators model as a predictor of the prices of the assets used by TransGrid to provide network services, and
- TransGrid has not provided any supporting evidence to show that it has considered whether there may be some material exogenous factors that impact on the cost of physical inputs that are not captured by the material input cost models used by TransGrid.

Our approach to real materials cost escalation discussed above does not affect the proposed application of labour and construction cost escalators which apply to TransGrid's standard control services capital expenditure. We consider that labour and construction cost escalation as proposed by TransGrid is likely to more reasonably reflect a realistic expectation of the cost inputs required to achieve the capex criteria given these are direct inputs into the cost of providing network services.[224]

D.2 TransGrid's proposal

TransGrid applied material and labour cost escalators to various asset classes in forecasting its capex for the 2014-19 period.[225] Real cost escalation indices for the following material cost drivers were calculated for TransGrid by SKM:[226]

- aluminium

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223 NER, clause 6A.6.7 (a).
224 NER, clause 6A.6.7 (c)(3).
225 TransGrid, *Revenue proposal*, p. 80.
226 TransGrid, *Revenue proposal, Appendix I: SKM, TransGrid - Commodity Price Escalation Forecast 2013/14 - 2018/19*, December 2013.

- copper
- steel
- oil; and
- construction.

SKM used November 2013 RBA data, daily forward rates from Bloomberg from November 2013 and the long term historical average USA/AUD exchange rate to convert commodities traded on international markets priced in United States dollars to Australian dollars.[227]

TransGrid also escalated the cost of land on which its assets are located.[228] TransGrid used BIS Shrapnel to forecast land prices.[229]

Table D-1 outlines TransGrid's real input materials escalation forecasts.

Table D-1 TransGrid's real materials cost escalation forecast—inputs (per cent)

	2014–15	2015–16	2016–17	2017–18	2018–19
Aluminium	4.69	4.88	3.09	4.42	2.97
Copper	-0.17	-0.17	-1.15	-0.16	-1.45
Steel	2.84	2.45	-0.35	0.38	-1.11
Oil	-5.11	-0.79	0.74	1.85	0.51
Construction costs	2.17	2.25	2.20	2.12	2.10
Land (residential)	6.2	5.1	1.3	-0.6	1.3
Land (industrial)	-0.8	-0.1	1.0	2.3	2.7
Land (rural)	4.4	3.9	1.7	1.1	2.6
Land (agricultural)	-1.2	-0.2	-0.7	2.0	1.5

Source: TransGrid, Revenue proposal, Appendix I: SKM, TransGrid - Commodity Price Escalation Forecast 2013/14 - 2018/19, December 2013, p. 2 (Without the continuation of existing carbon price mechanism from July 2014) and BIS Shrapnel, Appendix J: BIS Shrapnel, Property Value Escalation Forecasts, November 2013, p. (i).

On the basis of these individual material (and labour) cost escalators, TransGrid apportioned an escalation weighting based on the input cost escalators contribution to the total price of each asset.[230]

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227 TransGrid, *Revenue proposal, Appendix I: SKM, TransGrid - Commodity Price Escalation Forecast 2013/14 - 2018/19*, December 2013. December 2013, pp. 9-10.
228 TransGrid, *Revenue proposal*, p. 80.
229 TransGrid, *Revenue proposal, Appendix J: BIS Shrapnel, Property Value Escalation Forecasts*, November 2013.
230 TransGrid, *Revenue proposal, Capex model*,

D.3 Assessment approach

We assessed TransGrid's proposed real material cost escalators for the purpose of assessing its proposed total capex forecast against the NER requirements. We must accept TransGrid's capex forecast if we are satisfied it reasonably reflects the capex criteria.[231] Relevantly, we must be satisfied those forecasts reasonably reflect a realistic expectation of cost inputs required to achieve the capex objectives.[232]

We have applied our approach as set out in our Expenditure Forecast Assessment Guideline (Expenditure Guideline) to assessing the input price modelling approach to forecast materials cost.[233] In the Expenditure Guideline we stated that we had seen limited evidence to demonstrate that the commodity input weightings used by service providers to generate a forecast of the cost of material inputs have produced unbiased forecasts of the costs the service providers paid for manufactured materials.[234] We considered it important that such evidence be provided because the changes in the prices of manufactured materials are not solely influenced by the changes in the raw materials that are used.[235] As a result, the price of manufactured network materials may not be well correlated with raw material input costs. We expect service providers to demonstrate that their proposed approach to forecast manufactured material cost changes is likely to reasonably reflect changes in raw material input costs.

In our assessment of material cost escalation, we:

- reviewed the SKM and BIS Shrapnel reports commissioned by TransGrid[236]
- reviewed the capex model used by TransGrid; and
- reviewed the approach to forecasting manufactured material costs in the context of electricity service providers mitigating such costs and producing unbiased forecasts.

In forming our views, we also considered submissions by stakeholders. We received a submission from the Energy Markets Reform Forum (EMRF) which addressed materials escalation forecasts by TransGrid.[237] In its submission, the EMRF made the following statements in respect of materials escalation forecasts:[238]

- SKM forecasts for materials costs increases for the 2014–2018 period appears at odds with a report by Bloomberg that shows that materials used in the electricity industry are likely to fall
- TransGrid and SKM do not provide the weighting of each material element to its mix of materials and demonstrate that the weighting is reflective of the actual mix of the various elements that comprise the final adjustment to the cost of materials

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231 NER, cll. 6A.6.7(c) and 6A.14.1(2)(i).
232 NER, cl. 6A.6.7 (c).
233 AER, *Better Regulation - Explanatory Statement Expenditure Forecast Assessment Guideline,* November 2013, pp. 50-51.
234 AER, *Better Regulation - Explanatory Statement Expenditure Forecast Assessment Guideline*, November 2013, p. 50.
235 AER, *Better Regulation - Explanatory Statement Expenditure Forecast Assessment Guideline*, November 2013, p. 50.
236 TransGrid, *Revenue proposal, Appendix I: SKM, TransGrid - Commodity Price Escalation Forecast 2013/14 - 2018/19*, December 2013 and *, Appendix J: BIS Shrapnel, Property Value Escalation Forecasts*, November 2013.
237 The Energy Markets Reform Forum, *NSW Electricity Transmission Revenue Reset - TransGrid Application - A response*, July 2014.
238 The Energy Markets Reform Forum, *NSW Electricity Transmission Revenue Reset* - TransGrid *Application - A response*, July 2014, pp. 22–25 and Appendix 1 – Five-year drop for commodities' prices.

- materials cost movements are based on assumptions that are inappropriate for the use they are applied. EMRF questioned how accurate and robust these forecasts have been in the past and whether there been any assessment to compare the forecasts with actual costs to identify the degree of accuracy implicit in the forecasts, and

- to overcome input cost forecasting inaccuracies, an escalation factor unique to the energy market could be used. The AER would generate this escalation factor annually for adjustments to allowed revenues rather than use the CPI. Using an industry specific escalation index would reduce the inaccuracies inherent in the current AER approach and should result in a more equitable outcome for both consumers and networks.

D.4 Reasons

We must be satisfied that a forecast is based on a sound and robust methodology in order to accept that TransGrid's proposed total capex reasonably reflects the capex criteria.[239] This criteria includes that the total forecast capex reasonably reflects a realistic expectation of cost inputs required to achieve the capex objectives.[240] In making our assessment, we do recognise that predicting future materials costs for electricity service providers involves a degree of uncertainty. However, for the reasons set out below, we are not satisfied that the materials forecasts provided by TransGrid satisfy the requirements of the NER. Accordingly, we have not accepted it as part of our alternative estimate in our draft decision on total forecast capex. We are satisfied that zero per cent real cost escalation is reasonably likely to reflect the capex criteria and this has been taken into account into our alternative estimate.

Materials input cost model

TransGrid's capex model does not demonstrate how and to what extent material inputs have affected the cost of intermediate outputs such as cables and transformers. In particular, there is no supporting evidence to substantiate how accurately TransGrid's materials escalation forecasts reasonably reflected changes in prices they paid for intermediate outputs in the past to assess the reliability of forecast materials prices.

In our Expenditure Guideline, we requested service providers should demonstrate that their proposed approach to forecast materials cost changes reasonably reflected the change in prices they paid for physical inputs in the past. TransGrid's proposal does not include supporting data or information which demonstrates movements or interlink-ages between changes in the input prices of commodities and the prices TransGrid paid for physical inputs. TransGrid's capex model assumes a weighting of commodity inputs for each asset class but does not provide information which explains the basis for the weightings or that the weightings applied have produced unbiased forecasts of the costs of TransGrid's assets. For these reasons, there is no basis on which we can conclude that the forecasts are reliable. In summary, TransGrid has not demonstrated that their proposed approach to forecast materials cost changes reasonably reflects the change in prices they paid for assets in the past.

Materials input cost model forecasting

TransGrid has used its consultant's reports to estimate cost escalation factors in order to assist in forecasting future operating and capital expenditure. These cost escalation factors include commodity inputs in the case of capital expenditure. The consultants have adopted a high level approach hypothesising a relationship between these commodity inputs and the physical assets purchased by

239 NER, cl. 6A.6.7(c).
240 NER, cl. 6A.6.7(a).

TransGrid. Neither the consultant's reports nor TransGrid have successfully attempted to explain or quantify this relationship, particularly in respect to movements in the prices between the commodity inputs and the physical assets and the derivation of commodity input weightings for each asset class.

We recognise that active trading or futures markets to forecast prices of physical assets such as transformers are not available and that in order to forecast the prices of these physical assets a proxy forecasting method needs to be adopted. Nonetheless, that forecasting method must be reasonably reliable to estimate the prices of intermediate outputs used by service providers to provide network services. TransGrid has not provided any supporting information that indicates whether the forecasts have taken into account any material exogenous factors which may impact on the reliability of material input costs. Such factors may include changes in technologies which affect the weighting of commodity inputs, suppliers of the physical assets changing their sourcing for the commodity inputs, and the general volatility of exchange rates.

Materials input cost mitigation

We consider that there is potential for TransGrid to mitigate the magnitude of any overall input cost increases. This could be achieved by:

- potential commodity input substitution by the electricity service provider and the supplier of the intermediate outputs. An increase in the price of one commodity input may result in input substitution to an appropriate level providing there are no technically fixed proportions between the inputs. Although there will likely be an increase in the cost of production for a given output level, the overall cost increase will be less than the weighted sum of the input cost increase using the initial input share weights due to substitution of the now relatively cheaper input for this relatively expensive input.

  We are aware of input substitution occurring in the electricity industry during the late 1960's when copper prices increased, potentially impacting significantly on the cost of copper cables. Electricity service provider's cable costs were mitigated as relatively cheaper aluminium cables could be substituted for copper cables. We do however recognise that the principle of input substitutability cannot be applied to all intermediate outputs, at least in the short term, because there are technologies with which some inputs are not substitutable. However, even in the short term there may be substitution possibilities between operating and capital expenditure, thereby potentially reducing the total expenditure requirements of an electricity service provider.[241]

- the substitution potential between opex and capex when the relative prices of operating and capital inputs change[242] For example, TransGrid has not demonstrated whether there are any opportunities to increase the level of opex (e.g. maintenance costs) for any of its asset classes in an environment of increasing material input costs.

- the scale of any operation change to the electricity service provider's business that may impact on its capex requirements, including an increase in capex efficiency, and

- increases in productivity that have not been taken into account by TransGrid in forecasting its capex requirements.

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241 NER, cl. 6A.6.7(e)(7).
242 NER, cl. 6A.6.7(e)(6).

By discounting the possibility of commodity input substitution throughout the 2014-2018 period, we consider that there is potential for an upward bias in estimating material input cost escalation by maintaining the base year cost commodity share weights.

Forecasting uncertainty

The NER requires that an electricity service provider's forecast capital expenditure reasonably reflects a realistic expectation of cost inputs required to achieve the capex objectives.[243] We consider that there is likely to be significant uncertainty in forecasting commodity input price movements. The following factors have assisted us in forming this view:

- recent studies which show that forecasts of crude oil spot prices based on futures prices do not provide a significant improvement compared to a 'no-change' forecast for most forecast horizons, and sometimes perform worse[244]
- evidence in the economic literature on the usefulness of commodities futures prices in forecasting spot prices is somewhat mixed. Only for some commodities and for some forecast horizons do futures prices perform better than 'no change' forecasts;[245] and
- the difficulty in forecasting nominal exchange rates (used to convert most materials which are priced in $US to $AUS). A review of the economic literature of exchange rate forecast models suggests a "no change" forecasting approach may be preferable to the forward exchange rate produced by these forecasting models.[246]

Strategic contracts with suppliers

We consider that electricity service providers can mitigate the risks associated with changes in material input costs by including hedging strategies or price escalation provisions in their contracts with suppliers of inputs (e.g. by including fixed prices in long term contracts). We also consider there is the potential for double counting where contract prices reflect this allocation of risk from the electricity service provider to the supplier, where a real escalation is then factored into forecast capex. In considering the substitution possibilities between operating and capital expenditure,[247] we note that it is open to an electricity service provider to mitigate the potential impact of escalating contract prices by transferring this risk, where possible, to its operating expenditure.

Cost based price increases

Allowing individual material input costs that constitute cost escalation reflects more cost based price increases. We consider this cost based approach reduces the incentives for electricity service

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243 NER, cl. 6A.6.7(c)(3).

244 R. Alquist, L. Kilian, R. Vigfusson, *Forecasting the Price of Oil*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers, Number 1022, July 2011 (also published as Alquist, Ron, Lutz Kilian, and Robert J. Vigfusson, 2013, *Forecasting the Price of Oil*, in Handbook of Economic Forecasting, Vol. 2, ed. by Graham Elliott and Allan Timmermann (Amsterdam: North Holland), pp. 68-69 and pp. 427–508) and International Monetary Fund, *World Economic Outlook — Recovery Strengthens, Remains Uneven*, Washington, April 2014, pp. 25-31.

245 International Monetary Fund, *World Economic Outlook — Recovery Strengthens, Remains Uneven*, Washington, April 2014, p. 27, Chinn, Menzie D., and Olivier Coibion, *The Predictive Content of Commodity Futures*, Journal of Futures Markets, 2014, Volume 34, Issue 7, p. 19 and pp. 607-636 and T. Reeve, R. Vigfusson, *Evaluating the Forecasting Performance of Commodity Futures Prices*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers, Number 1025, August 2011, pp. 1 and 10.

246 R. Meese, K. Rogoff, (1983), *Empirical exchange rate models of the seventies: do they fit out of sample?*, Journal of International Economics, 14, B. Rossi, (2013), *Exchange rate predictability*, Journal of Economic Literature, 51(4), E. Fama, (1984), *Forward and spot exchange rates*, Journal of Monetary Economics, 14, K. Froot and R. Thaler, (1990), Anomalies: Foreign exchange, the Journal of Economic Perspectives, Vol. 4, No. 3, CEG, *Escalation factors affecting expenditure forecasts*, December 2013, and BIS Shrapnel, *Real labour and material cost escalation forecasts to 2019/20, Australia and New South Wales*, Final report, April 2014.

247 NER, cl. 6A.6.7(e)(7).

providers to manage their capex efficiently, and may instead incentivise electricity service providers to over forecast their capex. In taking into account the revenue and pricing principles, we note that this approach would be less likely to promote efficient investment.[248] It also would not result in a capex forecast that was consistent with the nature of the incentives applied under the CESS and the STPIS to TransGrid as part of this decision.[249]

Selection of commodity inputs

The limited number of material inputs included in TransGrid's cost escalation model may not be representative of the full set of inputs or input choices impacting on changes in the prices of intermediate outputs purchased by TransGrid. TransGrid's cost escalation model may also be biased to the extent that it may include a selective sub-set of commodities that are forecast to increase in price during the 2014–2018 period.

Commodities boom

The relevance of material input cost escalation post the 2009 commodities boom experienced in Australia when material input cost escalators were included in determining the approved capex allowance for electricity service providers. We consider that the impact of the commodities boom has subsided and as a consequence the justification for incorporating material cost escalation in determining forecast capex has also diminished.

D.4.1 Review of consultant's reports

We have reviewed the SKM report commissioned by TransGrid. We consider that this review, along with our review along with our review of two other reports detailed below, provides further support for our position to not accept TransGrid's proposed materials cost escalation.

SKM report

- SKM caution that there are a variety of factors that could cause business conditions and results to differ materially from what is contained in its forward looking statements.[250] This is consistent with our view that there are likely to be a significant number of material exogenous factors that impact on the cost of intermediate outputs that are not captured by TransGrid's capex model.
- SKM stated it used the Australian CPI to account for those materials or cost items for equipment whose price trend cannot be rationally or conclusively explained by the movement of commodities prices[251].
- In its modelling of the exchange rate, SKM has in part adopted the longer term historical average of $0.80 USD/AUD as the long term forecast going forward.[252] This is consistent with our view that longer term historical commodity prices should be considered when reviewing and forecasting future prices. In general, we consider that long term historical data has a greater number of observations and as a consequence is a more reliable predictor of future prices than a data time series of fewer observations.
- SKM stated that the future price position from the LME futures contracts for copper and aluminium are only available for three years out to December 2016 and that in order to estimate prices

248 NEL, Part 1, s. 7.
249 NER, cl. 6A.6.7(e)(8).
250 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 4.
251 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 8.
252 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 9.

beyond this data point, it is necessary to revert to economic forecasts as the most robust source of future price expectations.[253] SKM also stated that LME steel futures are still not yet sufficiently liquid to provide a robust price outlook.[254]

- SKM stated that in respect to the reliability of oil future contracts as a predictor of actual oil prices, futures markets solely are not a reliable predictor or robust foundation for future price forecasts. SKM also stated that future oil contracts tend to follow the current spot price up and down, with a curve upwards or downwards reflecting current (short term) market sentiment.[255] SKM selected Consensus Economics forecasts as the best currently available outlook for oil prices throughout the duration of the next regulatory control period[256]. The decision by SKM to adopt an economic forecast for oil rather than using futures highlights the uncertainty surrounding the forecasting of commodity prices.

In addition to our review of the SKM Report, we have also received submissions from ActewAGL, Ausgrid, Essential Energy, TasNetworks and Jemena Gas Networks on other resets we are currently undertaking. We have considered the relevance of those submissions to the issues raised by TransGrid in order to arrive at a position that takes into account all available information. Our views on these reports are set out below. Overall, both these reports lend further support to our position to not accept TransGrid's proposed materials cost escalation.

CEG report

- CEG acknowledge that forecasts of general cost movements (e.g. consumer price index or producer price index) can be used to derive changes in the cost of other inputs used by electricity service providers or their suppliers separate from material inputs (e.g. energy costs and equipment leases etc.).[257] This is consistent with the Post-tax Revenue Model (PTRM) which reflects at least in part movements in an electricity service provider's intermediary input costs.

- CEG acknowledge that futures prices will be very unlikely to exactly predict future spot prices given that all manner of unexpected events can occur.[258] This is consistent with our view that there are likely to be a significant number of material exogenous factors that impact on the price of assets that are not captured by the material input cost models used by TransGrid.

- CEG provide the following quote from the International Monetary Fund (IMF) in respect of futures markets:[259]

  > While futures prices are not accurate predictors of future spot prices, they nevertheless reflect current beliefs of market participants about forthcoming price developments.

  This supports our view that there is a reasonable degree of uncertainty in the modelling of material input cost escalators to reliably and accurately estimate the prices of assets used by NSPs to provide network services. Whilst the IMF may conclude that commodity futures prices reflect market beliefs on future prices, there is no support from the IMF that futures prices provide an accurate predictor of future commodity prices.

- Figures 1 and 2 of CEG's report respectively show the variance between aluminium and copper prices predicted by the London Metals Exchange (LME) 3 month, 15 month and 27 month futures

253 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 12.
254 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p.16.
255 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 18.
256 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 20.
257 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, p. 3.
258 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, pp. 4-5.
259 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, p. 5.

less actual prices between July 1993 and December 2013.[260] Analysis of this data shows that the longer the futures projection period, the less accurate are LME futures in predicting actual commodity prices. Given the next regulatory control period covers a time span of 60 months we consider it reasonable to question the degree of accuracy of forecast futures commodity prices towards the end of this period.

Figures 1 and 2 also show that futures forecasts have a greater tendency towards over-estimating of actual aluminium and copper prices over the 20 year period (particularly for aluminium). The greatest forecast over-estimate variance was about 100 per cent for aluminium and 130 per cent for copper. In contrast, the greatest forecast under-estimate variance was about 44 per cent for aluminium and 70 per cent for copper.

- In respect of forecasting electricity service providers future costs, CEG stated that:[261]

> There is always a high degree of uncertainty associated with predicting the future. Although we consider that we have obtained the best possible estimates of the NSPs' future costs at the present time, the actual magnitude of these costs at the time that they are incurred may well be considerably higher or lower than we have estimated in this report. This is a reflection of the fact that while futures prices and forecasts today may well be a very precise estimate of current expectations of the future, they are at best an imprecise estimate of future values.

This statement again is consistent with our view about the degree of the precision and accuracy of futures prices in respect of predicting electricity service providers future input costs. CEG also highlights the (poor) predictive value of LME futures for actual aluminium prices.[262]

- CEG also acknowledge that its escalation of aluminium prices are not necessarily the prices paid for aluminium equipment by manufacturers. As an example, CEG referred to producers of electrical cable who purchase fabricated aluminium which has gone through further stages of production than the refined aluminium that is traded on the LME. CEG also stated that aluminium prices can be expected to be influenced by refined aluminium prices but these prices cannot be expected to move together in a 'one-for-one' relationship.[263]

GEG provided similar views for copper and steel futures. For copper, CEG stated that the prices quoted for copper are prices traded on the LME that meet the specifications of the LME but that there is not necessarily a 'one-for-one' relationship between these prices and the price paid for copper equipment by manufacturers.[264] For steel futures, CEG stated that the steel used by electricity service providers has been fabricated, and as such, embodies labour, capital and other inputs (e.g. energy) and acknowledges that there is not necessarily a 'one-for one' relationship between the mill gate steel and the steel used by electricity service providers.[265]

These statements by CEG support our view that the input cost estimation models used by TransGrid has not demonstrated how and to what extent material inputs have affected the cost of intermediate outputs. We note, as emphasised by CEG, there is likely to be significant value adding and processing of the raw material before the physical asset is purchased by TransGrid.

- CEG has provided data on historical indexed aluminium, copper, steel and crude oil actual (real) prices from July 2005 to December 2013 as well as forecast real prices from January 2014 to

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260 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, pp. 5–6.
261 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, p. 13.
262 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, p. 5.
263 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, p. 19.
264 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, p. 19.
265 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, p. 23.

January 2021 which were used to determine its forecast escalation factors.266 For all four commodities, the CEG forecast indexed real prices showed a trend of higher prices compared to the historical trend. Aluminium and crude oil exhibited the greatest trend variance. Copper and steel prices were forecast to remain relatively stable whist aluminium and crude oil prices were forecast to rise significantly compared to the historical trend.

BIS Shrapnel report

- BIS Shrapnel has forecast prices of gas service provider related materials to increase, in part due to movements in the exchange rate. BIS Shrapnel are forecasting the Australian dollar to fall to US$0.77 from mid-2016 to mid-2018[267]. This is significantly lower than the exchange rate forecasts by SKM of between US$0.91 to US$0.85 from 2014–15 to 2018–19.[268] CEG did not publish its exchange rate forecasts in its report but state that for the purposes of the report it sourced forward rates from Bloomberg until 2023.[269] BIS Shrapnel stated that exchange rate forecasts are not authoritative over the long term.[270]

  We consider the forecasting of foreign exchange movements during the next regulatory control period to be another example of the potential inaccuracy of modelling for material input cost escalation.

- In its forecast for general materials such as stationary, office furniture, electricity, water, fuel and rent, BIS Shrapnel assumed that across the range of these items, the average price increase would be similar to consumer price inflation and that the appropriate cost escalator for general materials is the CPI.[271] This treatment of general business inputs supports our view that where we cannot be satisfied that a forecast of real cost escalation for a specific material input is robust, and cannot determine a robust alternative forecast, zero per cent real cost escalation is reasonably likely to reflect the capex criteria and under the PTRM the electricity service provider's broad range of inputs are escalated annually by the CPI.

Comparison of consultant's cost escalation factors

To illustrate the potential uncertainty in forecasting real material input costs, we have compared the material cost escalation forecasts derived by the consultants as shown in Table D-2.

266 CEG, *Escalation factors affecting expenditure forecasts*, December 2013, Figures 3, 4 and 5, pp. 23, 25 and 28.
267 BIS Shrapnel, *Real Labour and Material Cost Escalation Forecasts to 2019/20 - Australia and New South Wales*, April 2014, p. 6.
268 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 10.
269 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 9.
270 BIS Shrapnel, *Real Labour and Material Cost Escalation Forecasts to 2019/20 - Australia and New South Wales*, April 2014, p. A-7.
271 BIS Shrapnel, *Real Labour and Material Cost Escalation Forecasts to 2019/20 - Australia and New South Wales*, April 2014, p. 48.

Table D-2 Real material input cost escalation forecasts ($ real 2012–13)

	2014–15 (%)	2015–16 (%)	2016–17 (%)	2017–18 (%)	2018–19 (%)
Aluminium					
CEG	4.2	5.8	5.0	4.2	3.6
SKM	4.69	4.88	3.09	4.42	2.97
BIS Shrapnel	1.4	5.6	3.9	11.0	-6.5
Range (low to high)	1.4 to 4.69	4.88 to 5.8	3.09 to 5.0	4.2 to 11.0	-6.5 to 3.6
Copper					
CEG	-0.9	1.1	0.3	-0.3	-0.7
SKM	-0.17	0.17	-1.15	-0.16	-1.45
BIS Shrapnel	-0.9	-1.5	0.3	9.3	-8.7
Range (low to high)	-0.9 to 0.17	-1.5 to 1.1	-1.15 to 0.3	-0.3 to 9.3	-8.7 to -0.7
Steel					
CEG	0.6	3.2	0.6	0.3	-0.1
SKM	2.84	2.45	-0.35	0.38	-1.11
BIS Shrapnel[1]	5.1	1.0	-0.2	8.0	-8.9
Range (low to high)	0.6 to 5.1	1.0 to 3.2	-0.35 to 0.6	0.3 to 8.0	-0.1 to -8.9
Oil					
CEG	-0.5	2.8	2.6	2.1	1.8
SKM	-5.11	-0.79	0.74	1.85	0.51
BIS Shrapnel[2]	1.4	-1.1	-0.2	6.5	-6.2
Range (low to high)	-5.11 to 1.4	-1.1 to 2.8	-0.2 to 2.6	1.85 to 6.5	-6.2 to 1.8
	2014–15 (%)	2015–16 (%)	2016–17 (%)	2017–18 (%)	2018–19 (%)

Source: CEG, *Escalation factors affecting expenditure forecasts*, December 2013, pp. 21, 24 and 27, SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 2 and BIS Shrapnel, *Real Labour and Material Cost Escalation Forecasts to 2019/20 - Australia and New South Wales*, April 2014, p. iii.

1 Asian market price as BIS Shrapnel believes the Asia market is more appropriate.[272]

2 BIS Shrapnel have forecast plastics prices based on price changes in Nylon-11 and HDPE (Polyethylene). BIS Shrapnel state that Castor Oil is the key raw material of Nylon-11 and because it does not have any historical data on Castor Oil, it has approximated Nylon-11 by using HDPE growth rates. HDPE (Polyethylene) prices are proxied by BIS Shrapnel using Manufacturing Wages, General Materials, and Thermoplastic Resin prices. BIS Shrapnel state that Thermoplastic Resin is primarily driven by Crude Oil.[273]

As Table D-2 shows, there is considerable variation between the consultant's commodities escalation forecasts. The greatest margin of variation is 10.1 per cent for aluminium in 2018–19, where CEG has forecast a real price increase of 3.6 per cent and BIS Shrapnel a real price decrease of 6.5 per cent. BIS Shrapnel's forecasts exhibit the greatest margin of variation but there also considerable variation between CEG and SKM's forecasts. These forecast divergences between consultants further demonstrate the uncertainty in the modelling of material input cost escalators to reliably and accurately estimate the prices of intermediate outputs used by service providers to provide network services. This supports our view that TransGrid's forecast real material cost escalators do not reasonably reflect a realistic expectation of the cost inputs required to achieve the capex objectives over the 2014–18 period.[274]

D.5 Conclusions on materials cost escalation

We are not satisfied that TransGrid has demonstrated that the weightings applied to the intermediate inputs have produced unbiased forecasts of the movement in the prices it expects to pay for its physical assets. In particular, TransGrid has not provided sufficient evidence to show that the changes in the prices of the assets they purchase are highly correlated to changes in raw material inputs.

SKM, in its report to TransGrid, cautioned that there are a variety of factors that could cause business conditions and results to differ materially from what is contained in its forward looking statements.[275] This is consistent with our view that there are likely to be a significant number of material exogenous factors that impact on the cost of assets that are not captured by TransGrid's capex model. SKM used the Australian CPI to account for those materials or cost items for equipment whose price trend cannot be rationally or conclusively explained by the movement of commodities prices.[276] SKM stated that the future price position from the LME futures contracts for copper and aluminium are only available for three years out to December 2016 and that in order to estimate prices beyond this data point, it is necessary to revert to economic forecasts as the most robust source of future price expectations.[277] SKM also stated that LME steel futures are still not yet sufficiently liquid to provide a robust price outlook.[278] SKM submitted that in respect to the reliability of oil future contracts as a predictor of actual oil prices, futures markets solely are not a reliable predictor or robust foundation for future price forecasts and instead adopted an economic forecast for oil rather.[279] The decision by SKM to adopt an economic forecast for oil rather than using futures highlights the uncertainty surrounding the forecasting of commodity prices.

Recent reviews of commodity price movements show mixed results for commodity price forecasts based on futures prices. Further, nominal exchange rates are in general extremely difficult to forecast

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272 BIS Shrapnel, *Real Labour and Material Cost Escalation Forecasts to 2019/20 - Australia and New South Wales*, April 2014, p. 40.
273 BIS Shrapnel, *Real Labour and Material Cost Escalation Forecasts to 2019/20 - Australia and New South Wales*, April 2014, p. iii.
274 NER, clause 6A.6.7 (a).
275 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 4.
276 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 8.
277 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 12.
278 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p.16.
279 SKM, *TransGrid Commodity Price Escalation Forecast 2013/14 - 2018/19*, 9 December 2013, p. 18.

and based on the economic literature of a review of exchange rate forecast models, a “no change” forecasting approach may be preferable.

It is our view that where we are not satisfied that a forecast of real cost escalation for materials is robust, and we cannot determine a robust alternative forecast, then real cost escalation should not be applied in determining a service provider's required capital expenditure. We accept that there is uncertainty in estimating real cost changes but we consider the degree of the potential inaccuracy of commodities forecasts is such that there should be no escalation for the price of input materials used by TransGrid to provide network services.

In previous AER decisions, namely our Final Decisions for Envestra's Queensland and South Australian networks, we took a similar approach. This was on the basis that as all of Envestra's real costs are escalated annually by CPI under its tariff variation mechanism, CPI must inform the AER's underlying assumptions about Envestra's overall input costs. Consistent with this, we applied zero real cost escalation and by default Envestra's input costs were escalated by CPI in the absence of a viable and robust alternative. Likewise, for TransGrid, we consider that in the absence of a well-founded materials cost escalation forecast, escalating real costs annually by the CPI is the better alternative that will contribute to a total forecast capex that reasonably reflects the capex criteria.

The CPI can be used to account for the cost items for equipment whose price trend cannot be conclusively explained by the movement of commodities prices. This approach is consistent with the revenue and pricing principles of the NEL which provide that a regulated network service provider should be provided with a reasonable opportunity to recover at least the efficient costs it incurs in providing direct control network services.[280]

D.6 Labour and construction escalators

Our approach to real materials cost escalation does not affect the application of labour and construction cost escalators, which will continue to apply to standard control services capital and operating expenditure.

We consider that labour and construction cost escalation more reasonably reflects a realistic expectation of the cost inputs required to achieve the opex and capex objectives.[281] We consider that real labour and construction cost escalators can be more reliably and robustly forecast than material input cost escalators, in part because these are not intermediate inputs and for labour escalators, productivity improvements have been factored into the analysis (refer to the opex attachment).

Construction costs can be forecast with greater precision because the drivers (construction and manufacturing wages, plant equipment and other fabricated metal products, and plant and equipment hire) are reasonably transparent and can be predicted with some degree of accuracy.

Further details on our consideration of labour cost escalators are discussed in the opex rate of change appendix of this decision (see attachment 7).

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280 NEL, s. 7A(2).
281 NER, cll. 6A.6.6(c)(3) and 6A.7(c)(3).

E Contingent projects

For the 2014–18 period, TransGrid proposed expenditure on two contingent projects with a combined value of $738.9 million ($2013–14). The two nominated contingent projects are Reinforcement Capacity in Southern New South Wales ($309 million) and Powering Sydney's Future ($430 million).

Generally, contingent projects are significant network augmentation projects that are reasonably required to be undertaken in order to achieve the capex objectives. However, unlike other proposed capex projects, the need for the project and the associated costs are not sufficiently certain. Consequently, expenditure for such projects does not form a part of our assessment of the total forecast capex that we approve in this determination. Such projects are linked to unique investment drivers (rather than general investment drivers such as expectations of load growth in a region) and are triggered by a defined 'trigger event'. The occurrence of the trigger event must be probable during the relevant regulatory control period.[282]

If, during the regulatory control period, the TNSP considers that the trigger event has occurred, then it may apply to us. At that time, we will assess whether the trigger event has occurred and the project meets the threshold. If satisfied of both, we would determine the efficient incremental revenue which is likely to be required in each remaining year of the regulatory control period as a result of the contingent project, and amend the revenue determination accordingly.[283]

E.1 Position

We are not satisfied that the trigger event proposed by TransGrid for its project to reinforce capacity in southern New South Wales satisfies the NER requirement that the trigger event is appropriate.[284] We consider the trigger event should be amended in order for us to be satisfied that this should be included as a contingent project.

We are not satisfied that TransGrid's Powering Sydney's Future project is a contingent project because it is not reasonably required to be undertaken in order to achieve the capex objectives and the occurrence of the trigger event is not probable in the 2014–18 period.[285]

E.2 Assessment approach

We reviewed each of TransGrid's proposed contingent projects against the NER requirements.[286] We considered whether:

- the proposed contingent project is reasonably required to be undertaken in order to achieve any of the capex objectives.[287]
- the proposed contingent project capital expenditure is not otherwise provided for in the capex proposal.[288] (Most relevantly, a TNSP must include forecast capex in its revenue proposal which it

282 NER, cl. 6A.8.1(c)(5).
283 NER, cl. 6A.8.2.
284 NER, cl. 6A.8.1(b)(4).
285 NER, cll. 6A.8.1(b)(1) and (4); 6A.8.1(c)(5).
286 NER, cl. 6A.8.1.
287 NER, cl. 6A.8.1(b)(1).
288 NER, cl. 6A.8.1(b)(2)(i).

considers is required in order to meet or manage expected demand for prescribed transmission services over the regulatory control period.[289])

- the proposed contingent project capital expenditure reasonably reflects the capex criteria, taking into account the capex factors.[290] Importantly this requires the expenditure to be efficient.
- the proposed contingent project capital expenditure exceeds the defined threshold.[291]
- the trigger events are appropriate. This includes having regard to the need for the trigger event
- to be reasonably specific and capable of objective verification.[292]
- to be a condition or event which, if it occurs, makes the project reasonably necessary in order to achieve any of the capex objectives.[293]
- to be a condition or event that generates increased costs or categories of costs that relate to a specific location rather than a condition or event that affects the transmission network as a whole.[294]
- is described in such terms that it is all that is required for the revenue determination to be amended.[295]
- is probable during the 2014–18 period but the inclusion of capex in relation to it (in the total forecast capex) is not appropriate because either it is not sufficiently certain that the event or condition will occur during the regulatory control period or if it may occur after that period or not at all; or (and assuming it meets the threshold) the costs associated with the event or condition are not sufficiently certain.[296]

We also considered the interaction between the total forecast capex that we approve and projects included as contingent projects. This interaction reflects that a TNSP may recover its expenditure on capex projects in two ways.

As set out in Attachment 6, we have approved an estimate of total forecast capex that TransGrid requires for the regulatory control period. This estimate reasonably reflects the capex criteria, which is based on what a service provider needs to meet to deliver the prescribed transmission services in accordance with the capex objectives. Our assessment of what a service provider needs includes consideration of the foreseeable increases in demand across the network during the regulatory control period and to some extent, assessing the probability of a range of projects.

The TNSP is expected to manage its business within this approved estimate. Not all possible projects identified by the TNSP as part of its revenue proposal and considered in our assessment of that proposal, may be undertaken. Some projects may be undertaken that were not identified during the revenue determination. The projects ultimately undertaken will be determined through the TNSP's asset management framework in response to circumstances as they develop. This approach provides an incentive for the TNSP to provide services efficiently since if its costs are lower than the total forecast capex approved, it retains the difference.

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289 NER, cl. 6A.6.7(a)(1).
290 NER, cl. 6A.8.1(b)(2)(ii).
291 NER, cl. 6A.8.1(b)(2)(iii).
292 NER, cl. 6A.8.1(c)(1).
293 NER, cl. 6A.8.1(c)(2).
294 NER, cl. 6A.8.1(c)(3)
295 NER, cl. 6A.8.1(c)(4).
296 NER, cl. 6A.8.1(c)(5).

Second, a TNSP may nominate specific projects as contingent projects. When a contingent project is triggered, the revenue determination is amended and additional revenue is allowed in the regulatory control period. Generally, contingent projects are large projects which are less certain than any projects a TNSP may have proposed and which we considered when assessing the total forecast capex as part of the revenue determination. They are also linked to specific triggers. For example, a major new load such as a mine may be under consideration by a potential customer. It is uncertain whether the project will go ahead, but if it does, it will require substantial augmentation of the system. Such a project is a good example for nomination as a contingent project. If it were included in the ex-ante allowance there is a high likelihood that customers could be disadvantaged because they would be required to pay even if the project does not proceed. Treating such a less certain, but high revenue impact project as a contingent project means that customers are not required to pay unless the project goes ahead and the need for additional expenditure is clear. The interests of the TNSP are also protected as any additional costs not included in the ex-ante allowance can be recovered subject to us being satisfied, on application by a service provider, that the trigger event has occurred and the forecast capex for the project meets the threshold.[297]

Where a TNSP has proposed a project in its revenue proposal and that project is provided for in the total forecast capex which we accept, it cannot also be included as a contingent project.[298]

In considering TransGrid's proposed contingent projects we had regard to:

- TransGrid's revenue proposal, including attachments[299]
- submissions[300]
- the Australian Energy Market Operator (AEMO) report[301]
- Energy Market Consulting Associates' (EMCa) technical review of Ausgrid's proposal.[302]

E.3 TransGrid's proposal

TransGrid proposed two contingent projects in its revenue proposal – Reinforcement of Capacity in Southern New South Wales and Powering Sydney's Future.[303]

The Reinforcement of Capacity in Southern New South Wales project has been identified following a number of enquiries for the connection of new generation in southern NSW. TransGrid submitted that some new generation has been commissioned or is at an advanced design stage, and further new generation is forecast to be commissioned towards the end of the regulatory control period.[304] TransGrid submitted that there is opportunity to increase market benefits to the market participants by reinforcing the transfer capability between the Snowy and Yass/Canberra area. TransGrid stated that there are presently uncertainties around generation developments, decommissioning, mothballing and re-powering, making it difficult to predict the most opportune time to commit to transmission capacity

297 NER, cl. 6A.8.2.
298 NER, cl. 6A.8.1(b)(2)(i).
299 TransGrid, *Revenue proposal*. pp. 80–83 *and Appendix L - Contingent projects*, May 2014.
300 The AER received a submission on contingent projects from electricity generators and the Energy Users Association of Australia.
301 AEMO's Independent Planning Review – New South Wales and Tasmanian transmission networks - Attachment A TransGrid Project Assessment Reports.
302 EMCa, *Review of Proposed Replacement Capex in AUSGRID's Regulatory Proposal 2014 - 2019*, November 2014.
303 TransGrid, *Revenue proposal 2014/15 – 2018/19,* May 2014, pp. 80-83.
304 TransGrid, *Revenue proposal 2014/15 – 2018/19,* May 2014, p. 83.

augmentation. However, TransGrid submitted that it is probable that significant market benefits may be accrued from 2015 onwards.[305]

Powering Sydney's Future is a TransGrid project to investigate the underlying factors that may drive the need to reinforce supply capacity to the Sydney inner metropolitan area and central business district. TransGrid submitted that it is difficult to predict the most opportune time to commit for transmission capacity augmentation given the uncertainties around future demand in the Sydney area, and in particular the impact of the demand management and energy efficiency programs. However, it is currently anticipated that this capacity augmentation will be required in the period from 2018 to 2024.[306]

Table E-1 lists TransGrid's proposed contingent projects, proposed trigger events and estimated costs.

Table E-1 TransGrid's proposed contingent projects

Project	Proposed trigger event	Estimated cost (nominal)
Powering Sydney's Future	1. Demand forecasts that draw on external sources, including the economic application of demand reduction initiatives, resulting in the loading of the defined constraint exceeding its contingent MVA rating (based on applicable reliability criteria at the time) within the next four years, taking into consideration the necessary actions to manage the risk associated with existing aged cables; and 2. Successful completion of the RIT-T including a comprehensive assessment of credible options showing that an investment is justified; and 3. TransGrid Board commitment to proceed with the project subject to the AER amending TransGrid's revenue determination pursuant to the NER.	$430 million
Reinforcement of Capacity in Southern New South Wales	1. AEMO classification of generation developments as being at the 'committed' stage of development on their 'Generator Information' webpage: (i) exceeding 350 MW;* (ii) in Southern NSW around Yass/Canberra/Marulan area, or any additional connection points established in this vicinity; and 2. Successful completion of the RIT-T, including a comprehensive assessment of credible options showing a transmission investment is justified; and 3. TransGrid Board commitment to proceed with the project subject to the AER amending the revenue determination pursuant to the NER.	$308.9 million

Source: TransGrid, *Revenue proposal 2014/15 – 2018/19, Appendix L: Contingent Projects,* May 2014.

* Increase in generation from Snowy up to the existing Snowy – Canberra transmission capacity (2690 MW) and approximately 50 per cent of generation from the existing, committed and planned wind generation (which is likely to reach 925 MW during 2014–2018) will exceed the present transmission capacity across cut-set 4 (3120 MW).

[305] TransGrid, *Revenue proposal 2014/15 – 2018/19,* p. 83 and *Appendix L: Contingent Projects, Contingent Project: Southern NSW Network Upgrade,* May 2014, pp. 3-7

[306] TransGrid, *Revenue proposal 2014/15 – 2018/19,* pp. 81-83 and *Appendix L: Contingent Projects, Contingent Project: Powering Sydney's Future,* May 2014, pp. 3-9.

E.4 Reasons for draft decision

We do not accept TransGrid's proposed contingent projects. We consider each proposed contingent project:

- is not reasonably required to meet the capex objectives (and capex criteria for the 'Powering Sydney's future project' ; and/or
- the trigger event is not appropriate.[307]

Our review of each proposed contingent project follows.

E.4.1 Reinforcement Capacity in Southern New South Wales

TransGrid submitted that the transmission network linking the Snowy Mountains and Sydney may become congested under high summer demand scenarios, with high import from Victoria and high levels of southern New South Wales generation. TransGrid stated that this congestion could be exacerbated by the commissioning of new generation in southern New South Wales around the Yass–Canberra–Marulan area and that if this portion of the network becomes congested TransGrid propose the following works at a total estimated cost of $308.9 million:[308]

- increase the ratings of Upper Tumut – Canberra line 01 and 39 Bannaby – Sydney West line 39 by increasing the height of the conductor to allow a 100 degree Celsius operating temperature
- increase the ratings of Yass – Marulan lines 4 and 5 by increasing the height of the conductor to allow a 100 degree Celsius operating temperature
- install phase shifting transformers on Bannaby – Sydney West line 39, Gullen Range – Bannaby line 61 and Yass – Marulan line 5
- construct a new 330 kV single circuit line between Yass and Bannaby, and
- replace equipment at Sydney South, Dapto, Avon, and Macarthur substations.

Trigger event

TransGrid has proposed the following trigger event for this proposed contingent project:[309]

1. AEMO classification of generation developments as being at the 'committed' stage of development on their 'Generator Information' webpage:

   (i) exceeding 350 MW;[310]

   (ii) in southern NSW around Yass/Canberra/Marulan area, or any additional connection points established in this vicinity; and

2. Successful completion of the RIT-T, including a comprehensive assessment of credible options showing a transmission investment is justified; and

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307 NER, cl. 6A.8.1(b)(4).
308 TransGrid Revenue Proposal, Appendix L - Contingent Projects, p4.
309 TransGrid Revenue Proposal, Appendix L - Contingent Projects, p5.
310 Increase in generation from Snowy up to the existing Snowy – Canberra transmission capacity (2690 MW) and approximately 50% of generation from the existing, committed and planned wind generation (which is likely to reach 925 MW during 2014 – 2018) will exceed the present transmission capacity across cut-set 4 (3120 MW).

3. TransGrid Board commitment to proceed with the project to the AER, seeking an amendment to the revenue determination pursuant to the NER.

AER considerations

In its proposal, TransGrid submitted a network capability incentive parameter action plan (NCIPAP) which includes projects to install equipment to enable dynamic line ratings on a number of critical lines in Southern New South Wales.[311] The first two stages of the proposed contingent project increase the ratings of lines by increasing the height of the conductor to allow a higher operating temperature. These same lines are also included in the NCIPAP dynamic line ratings projects. TransGrid justified these projects on the basis that:[312]

> The benefit is avoidance of the market impact due to the present 4, 5, 9, 61 and 39 Line limits, under favourable conditions.
>
> Renewable generation developments in Southern NSW, driven by the Renewable Energy Target (RET) are likely to increase the power transfer on 4, 5, 9, 61 and 39 Lines. The benefits of this project are the avoidance of wind generation being constrained off and thermal generation dispatched in its place. This has been modelled at $176k per year, consistent with NTNDP scenarios. This would provide a payback period of approximately 15 years based on current modelling.

We accept that the NCIPAP projects that introduce dynamic line ratings enable the thermal rating of a line to be set in real time according to weather conditions and that this can lead to increases in the thermal rating of up to 20 per cent during times of favourable conditions, such as lower ambient temperatures and high wind speed.[313]

In our view much of the potential future congestion in the 330 kV transmission lines between the Snowy region and Sydney is expected to be caused by high levels of new wind generation investment in response to the RET.

As such, it is likely that the dynamic ratings introduced under the NCIPAP will assist in reducing potential congestion by allowing higher line ratings as a result of high wind speed, which will be coincident with high levels of wind generation and the potential for increased congestion.[314] However, the NCIPAP projects are complementary to this contingent project not a substitute for it. The proposed contingent project capital expenditure is therefore not otherwise provided for in TransGrid's proposal.

AEMO has analysed this contingent project, and its interaction with the NCIPAP and stated that:[315]

> If dynamic line ratings allowed a 10% increase on the Yass-Marulan 330 kV line 4 and 5, and the Bannaby-Sydney West 330 kV line 39, it may be possible to increase power transfer on the 330 kV transmission lines between the Snowy region and Sydney by approximately 400 MW.

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311 TransGrid, *Revenue Proposal*, May 2014, Appendix AG - Network Capability Incentive Parameter Action Plan, Section 3.5 Dynamic Line Ratings and Transmission Line Uprating.

312 TransGrid, *Revenue Proposal*, May 2014, Appendix AG - Network Capability Incentive Parameter Action Plan, p. 20.

313 Higher power flows, higher temperatures and lower wind speeds heat the conductor and cause it to expand. This expansion increases that conductor sag and reduces ground clearance. Conversely, lower power flows, low ambient temperatures and higher wind speeds reduce conductor temperature and increase the ground clearance. The maximum allowable power flow is therefore related to the design of the line and ambient weather conditions. Static ratings of transmission lines assume a worse case for ambient conditions (low wind speed and high ambient temperature), while dynamic ratings measure ambient conditions, which usually results in a higher allowable power flow.

314 This increase in ratings is likely for all the lines that are the subject of the first two stages of the contingent project, although the 39 line may be subject to different weather patterns and therefore its improvement may be less.

315 AEMO's Independent Planning Review – New South Wales and Tasmanian transmission networks - Attachment A TransGrid Project Assessment Reports, p. 21.

At the time of submission of TransGrid's revenue proposal there were three committed generation projects in the southern New South Wales network, with a combined capacity of 385 MW. Since then two of the projects have commenced commissioning, with the third (the 107 MW Taralga Wind Farm) about to commence. Since the submission of TransGrid's revenue proposal there has been no change in the status of any of the publicly announced projects and so the situation is broadly unchanged.[316]

AEMO's analysis concluded that:[317]

> AEMO considers that TransGrid's proposed augmentation of these transmission lines should be contingent on:
>
> a. Enablement of dynamic ratings as per TransGrid's NCIPAP submission, should it be approved.
>
> b. The 350 MW of committed generation projects in southern New South Wales around Yass–Canberra–Marulan area, or any additional connection points established in this vicinity.
>
> c. Successful completion of the Regulatory Investment Test for Transmission (RIT–T) showing positive market benefits for the augmentation.
>
> This is given:
>
> - Uncertainty over the RET. Wind generation in Southern New South Wales is likely to cause congestion in the 330 kV transmission lines between the Snowy region and Sydney. While there are three committed wind farms projects in the Southern New South Wales area, future wind generation developments will likely depend on the RET.
> - The performance and availability of dynamic ratings. Enabling dynamic ratings on critical circuits the 330 kV transmission lines between the Snowy region and Sydney may significantly increase the capacity of these lines during periods of high wind generation.'

Table E**-**2 summarises our assessment of TransGrid's proposed reinforcement of capacity in southern New South Wales contingent project.

316 AEMO advice.

317 AEMO's Independent Planning Review – New South Wales and Tasmanian transmission networks - Attachment A TransGrid Project Assessment Reports, p. 22.

Table E-2 AER assessment of the Reinforcement of Capacity in Southern New South Wales contingent project

NER criteria	AER assessment
Reasonably required to meet the capex objectives[318]	Subject to the findings of a RIT-T and AER review of the RIT-T
Proposed capex is not otherwise provided for in the capex proposal[319]	There is no evidence of the proposed capex being included in any other area of TransGrid's proposal
Proposed capex reasonably reflects the capex criteria taking into account the capex factors[320]	Subject to the findings of a RIT-T and AER review of the RIT-T
Proposed capex exceeds the defined threshold[321]	Proposed capex exceeds the defined threshold of $30 million or 5 per cent of the value of the maximum allowed revenue for the first year of the Regulatory Control Period ($46.6m)
Trigger event appropriate: ▪ the trigger events are reasonably specific and objectively verifiable[322] ▪ if the trigger events occur then the project is reasonably required to achieve the capex objectives[323] ▪ the trigger events generate increased costs related to a specific location[324] ▪ described in such terms that the occurrence of that event or condition is all that is required for the revenue determination to be amended[325] ▪ the occurrence of the trigger event is probable during the 2014–18 regulatory control period but the inclusion of the proposed capital expenditure is not appropriate due to timing or cost uncertain[326]	We consider that the completion of a RIT–T is not an appropriate trigger event and propose an alternative trigger event It is likely that a modified trigger event would result in increased costs that are specific to resolving generation congestion in southern NSW

It is evident given the above context that the trigger event proposed by TransGrid relating to the completion of the RIT-T is not sufficient. In particular, there is a need for it to be clear that should the event occur, it makes the undertaking of the proposed contingent project reasonably necessary in order to achieve any of the capex objectives, specifically to meet or manage expected demand for

318 NER, cl. 6A.8.1(b)(1).
319 NER, cl. 6A.8.1(b)(2)(i).
320 NER, cl. 6A.8.1(b)(2)(ii).
321 NER, cl. 6A.8.1(b)(2)(iii).
322 NER, cl. 6A.8.1(c)(1).
323 NER, cl. 6A.8.1(b)(1).
324 NER, cl. 6A.8.1(c)(3).
325 . NER, cl. 6A.8.1(b)(2)(i).
326 NER, cl. 6A.8.1(c)(5).

prescribed transmission services.[327] Instead, we consider the following indicative trigger events are required in order to be satisfied that this project should be included as a contingent project:

1. Successful completion of the regulatory investment test for transmission demonstrating positive net market benefits.

2. Determination by the AER under clause 5.16.6 of the NER that the proposed investment satisfies the regulatory investment test for transmission (compliance review).

3. TransGrid Board commitment to proceed with the project prior to submitting an application to the AER seeking an amendment to the revenue determination pursuant to the NER.

These further conditions are seen as necessary because the occurrence of the trigger event in the current period will be impacted by the following factors:

- Change in dynamic ratings - we acknowledge AEMO's view that the dynamic line ratings (in the NCIPAP) increase power transfer on the 330 kV transmission lines between the Snowy region and Sydney by approximately 400 MW. We consider that this is likely to increase the amount of transmission capacity to meet the needs of new committed generation before any material congestion between the Snowy region and Sydney occurs. The regulatory investment test for transmission assesses whether the removal of this congestion through expenditure on this augmentation is efficient (by demonstrating positive net market benefits). The threshold level for new generation in southern NSW is therefore higher than assumed by TransGrid in its proposal which is merely the economic need for this contingent project.

- Uncertainty over the future of the RET. A substantial change to the RET may reduce the probability of this contingent project being economic and therefore the validity of this contingent project.

- Electricity spot market prices are at historically low levels at present and demand is declining reflecting substantial excess generation capacity. This reduces the need for further generation and increases the threshold for net market benefits under the RIT-T

Notwithstanding, if the current RET remains in place it is possible that during the 2014–18 period southern NSW could see a sufficient influx of new generation. If so, the economic need of TransGrid's proposed augmentation investment will be fully assessed in the relevant regulatory investment test for transmission. We consider that the Reinforcement of Capacity in Southern New South Wales contingent project satisfies the other NER requirements for a contingent project. We consider the contingent project is reasonably required to be undertaken in order to achieve the capex objectives, in particular the requirement to meet or manage the expected demand for prescribed transmission services during the 2014–18 period.[328]

We also consider that the proposed contingent capex reasonably reflects the capex criteria in the context of the proposed contingent project as described in TransGrid's revenue proposal.[329] TransGrid's description is the basis for this conclusion. As a contingent project, we consider the costs are not sufficiently certain at this stage such that they can be fully substantiated by TransGrid.[330] As explained above, should the trigger event occur and TransGrid apply to amend its determination to account for this contingent project, we will assess then whether the forecast costs submitted by

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327 NER, cl. 6A.8.1(c)(2)
328 NER, cl. 6A.6.8(b)(1).
329 NER, cl. 6A.8.1(b)(2)(ii);
330 NER, cl. 6A.8.1(c)(5)(ii))

TransGrid in its application, meet the NER requirements. At the time of that assessment, whether the proposed capex is prudent and efficient would be clarified to some extent by the occurrence of the modified trigger events.

We are also satisfied that the proposed contingent project is not otherwise provided for in TransGrid's capex proposal[331] and the capital expenditure exceeds the defined threshold.[332]

If TransGrid proposed a modified trigger that ensures a compliant RIT-T, as determined by us, we consider in principle that the reinforcement of capacity in southern New South Wales would satisfy the NER requirements for a contingent project as:

- the project is reasonably required to be undertaken in order to achieve the capex objectives
- the proposed contingent capex is not otherwise provided for in the capex proposal,
- it reasonably reflects the capex criteria in the context of the proposed contingent project as described in the Revenue Proposal
- the cost of the project exceeds the defined threshold ($30 million or 5 per cent of the value of the maximum allowed revenue for the first year of the regulatory control period), and
- the occurrence of the trigger event is probable during the 2014–18 period.

We note that this approach reflects our recent decision for ElectraNet.[333]

E.4.2 Powering Sydney's future

TransGrid submitted that the security of supply to the inner Sydney area could be affected by a number of recent and upcoming events. In its review of the New South Wales transmission network, AEMO stated that TransGrid and Ausgrid have decreased the rating of the Sydney South-Beaconsfield 330 kV cable and multiple 132 kV cables servicing the inner Sydney area. AEMO also stated that Ausgrid are planning to retire additional multiple 132 kV cables feeding the inner Sydney area. AEMO concluded that these events reduce the capacity of the network to meet growing inner Sydney area demand. [334]

To address these issues TransGrid proposed expenditure to:[335]

- proactively purchase demand-side response in the Sydney area
- manage Cable 41 loading and rating (via back fill remediation and series reactor switching)
- acquire property in anticipation of network augmentation, and
- augment the network (the proposed contingent project), with the following options:
    - a full 330 kV solution (a new 330 kV cable from Rookwood Road substation to Beaconsfield substation)

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331 NER, cl. 6A.6.8(b)(2)(i).
332 NER, cl. 6A.6.7(b)(2)(iii).
333 AER, *Draft decision ElectraNet Transmission determination 2013–14 to 2017–18*, November 2012, p. 251.
334 AEMO's Independent Planning Review – New South Wales and Tasmanian transmission networks - Attachment A TransGrid Project Assessment Reports, p. 11
335 TransGrid, *Revenue proposal,* May 2014, pp. 81-83 and *Appendix L: Contingent Projects, Contingent Project: Powering Sydney's Future,* May 2014, pp. 3-9.

- a mix of 330 kV and 132 kV solutions, and
- a full 132 kV solution.

TransGrid estimates cost of the network augmentation at $430 million.[336]

Trigger event

TransGrid has proposed the following trigger event for this proposed contingent project:[337]

1. Demand forecasts that draw on external sources (such as Ausgrid and/or AEMO connection point forecasts), including the economic application of demand reduction initiatives resulting in the loading of the defined constraint cut-set exceeding its contingent MVA rating (based on the applicable reliability criteria at the time) within the next four years, taking into consideration the necessary actions to manage the risk associated with existing aged cables; and
2. Successful completion of the RIT-T including a comprehensive assessment of credible options showing that an investment is justified; and
3. TransGrid Board commitment to proceed with the project subject to the AER amending TransGrid's revenue determination pursuant to the NER.

Our considerations

TransGrid has based this proposed contingent project on Ausgrid's 2013 demand forecasts and Ausgrid's proposed timing for the retirement of a number of 132 kV cables that currently supply the greater Sydney CBD area. In its proposal, TransGrid showed the impact of Ausgrid's cable retirements on network capacity.[338] Under this scenario, TransGrid expects the load at risk to increase significantly from 2018–19.[339] However, updated draft demand forecasts from Ausgrid show a reduction of about 300 MW with cable retirements remaining unchanged.[340] Based on this draft demand forecast from Ausgrid, the need for the Powering Sydney's Future contingent project moves to 2021–22.[341]We have received draft advice from TransGrid that it considers that the proposed contingent project may no longer be supported by the revised draft 2014 draft demand forecast from Ausgrid.[342] We understand that Ausgrid will finalise these draft demand forecasts in December 2014.

Based on the most recent, updated demand forecasts, we do not consider that the proposed contingent Powering Sydney's Future project is required to achieve the capex objectives and the occurrence of the trigger event is not reasonably probable in the 2014–18 period. Table E-3 summarises our assessment of this proposed contingency project.

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336 TransGrid, *Revenue proposal 2014/15 – 2018/19,* May 2014, p. 83.
337 TransGrid, *Revenue proposal 2014/15 – 2018/19,* May 2014, p. 82.
338 TransGrid, *Revenue proposal 2014/15 – 2018/19, Appendix L: Contingent Projects, Contingent Project: Powering Sydney's Future,* May 2014, p. 4.
339 TransGrid, *Revenue proposal 2014/15 – 2018/19, Appendix L: Contingent Projects, Contingent Project: Powering Sydney's Future,* May 2014, p. 4.
340 14 October email from TransGrid.
341 Ausgrid, *AER AUSGRID 039 - updated demand forecasts*, 24 September 2014 email from Ausgrid.
342 14 October email from TransGrid.

Table E-3 AER assessment of the Powering Sydney's Future contingent project

NER criteria	AER assessment
Reasonably required to meet the capex objectives[343]	The 2014 draft demand forecast for the Sydney area does not demonstrate the need for this project and demand in this area is likely to be even lower than this latest draft forecast as a result of demand management and embedded generation initiatives in the area. Our consultant EMCa considered that Ausgrid's approach to asset replacement resulted in the early retirement of assets and we are of the view that Ausgrid's proposed cable retirement program is likely to be several years earlier than reasonably required to economically manage the risk associated with these assets.[344]
Proposed capex is not otherwise provided for in the capex proposal[345]	There is no evidence of the proposed capex being included in any other area of TransGrid's proposal
Proposed capex reasonably reflects the capex criteria taking in to account the capex factors[346]	See comments against capex objectives above
Proposed capex exceeds the defined threshold[347]	Proposed capex exceeds the defined threshold of $30 million or 5 per cent of the value of the maximum allowed revenue for the first year of the Regulatory Control Period ($46.6m)
Trigger event appropriate: ▪ the trigger events are reasonably specific and objectively verifiable[348] ▪ if the trigger events occur then the project is reasonably required to achieve the capex objectives[349] ▪ the trigger events generate increased costs related to a specific location[350] ▪ described in such terms that the occurrence of that event or condition is all that is required for the revenue determination to be amended[351] ▪ the occurrence of the trigger event is probable during the 2014–18 period but the inclusion of the proposed capital expenditure is not appropriate due to timing or cost uncertainty[352]	The trigger event is not reasonably probable in the 2014-18 period given that the updated draft demand forecast since TransGrid submitted its proposal does not demonstrate the need for the project and demand is likely to be even lower than this latest draft demand forecast as a result of demand management and embedded generation initiatives in the area. The trigger event is not reasonably probable in the 2014-18 period given that EMCa found that Ausgrid's approach to asset replacement resulted in the early retirement of assets. Given EMCa found systemic issues in relation to risk that lead to an overstatement of Ausgrid's asset replacement costs we are of the view that Ausgrid's proposed cable retirement program is likely to be earlier than reasonably required to economically manage the risk associated with these assets.

343 NER, cl. 6A.8.1(b)(1).
344 EMCa, *Review of Proposed Replacement Capex in AUSGRID's Regulatory Proposal 2014 - 2019*, October 2014.
345 NER, cl. 6A.8.1(b)(2)(i).
346 NER, cl. 6A.8.1(b)(2)(ii).
347 NER, cl. 6A.8.1(b)(2)(iii).
348 NER, cl. 6A.8.1(c)(1).
349 NER, cl. 6A.8.1(b)(1).
350 NER, cl. 6A.8.1(c)(3).
351 NER, cl. 6A.8.1(b)(2)(i).
352 NER, cl. 6A.8.1(c)(5).

The timing of the proposed contingent project is predicated on the expected demand in the greater Sydney CBD area and Ausgrid's proposed timing of retirement of a number of 132 kV cables. Ausgrid's 2014 updated draft demand forecast shows that the expected demand will not exceed the available capacity in the 2014–18 period given Ausgrid's proposed timing of 132 kV cable retirements, and we consider that the draft forecast updated since TransGrid submitted its proposal does not support the need for the proposed contingent project.

In addition to the expected reduction in demand between Ausgrid's 2013 and 2014 forecasts (about 300 MW) the City of Sydney Council is proposing to install 477 MW of tri-generation in the Sydney CBD area by 2030.[353] We consider that in addition to the underlying factors driving reduced demand in the Sydney area, these proposals are likely to result in further significant mitigation in demand. Consequently, we are of the view that it is unlikely that demand growth in the greater Sydney CBD area would be sufficient to trigger the proposed Powering Sydney's Future contingent project in the 2014–18 period.

As the proposed contingent project is also predicated on the timing of Ausgrid's retirement of the 132 kV cables, we consider it relevant to consider if this timing is likely to lead to the trigger being probable in the 2014–18 period. In its review of Ausgrid's asset replacement capex (repex), EMCa concluded that Ausgrid overstates it repex needs due to the lack of accuracy and reliability of its age, condition and failure data as well as a tendency to apply overly conservative risk ratings which results in triggering early or unnecessary replacements. EMCa also stated that they could find no reviews or adjustments that would address such biases.[354]

On the basis of the systemic issues identified by EMCa, we consider that the timing of Ausgrid's proposed 132 kV cable retirements is likely to be earlier than reasonably required to economically manage the risk associated with these assets. We therefore consider that it is more likely that the timing of the 132 kV cable retirements will be later than the timing used by TransGrid in considering the likely need for the proposed contingent project in the 2014–18 period. As such, we consider it is unlikely that Ausgrid's cable retirement could trigger the proposed contingent project during the 2014–18 period even where demand is higher than forecast.

For these reasons we do not accept the Powering Sydney's Future as a contingent project in the 2014–18 period.

Interrelationships

TransGrid proposed the procurement of pre-emptive network support to attempt to defer the timing of new network investment, including network support to build the capability of the market.[355] TransGrid stated that to succeed in deferring network investment by use of a network support alternative, it considers it essential that "pre-emptive" network support be included in the operating expenditure allowance from summer 2014–15 to summer 2017–18, to develop the network support market in the inner Sydney area.[356] TransGrid has proposed pre-emptive network support costs of $26.4 million ($2013–14) for the Powering Sydney's Future contingency project.[357] We do not consider that TransGrid's proposed network support costs for the Powering Sydney's Future contingency project is justified. Our reasons for this decision are discussed in the opex Attachment.

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353 City of Sydney, *Decentralised Energy Master Plan Trigeneration 2010–2030*, March 2013, p. 5.
354 EMCa, *Review of Proposed Replacement Capex in AUSGRID's Regulatory Proposal 2014 - 2019*, October 2014.
355 TransGrid, *Revenue proposal,* May 2014, p. 82.
356 TransGrid, *Revenue proposal,* May 2014, p. 84.
357 TransGrid, *Revenue proposal,* May 2014, p. 86.

TransGrid forecast capex of $19.5 million ($2013-14) for a strategic property acquisition and early works associated with the Powering Sydney's Future project. We are not satisfied that the forecast capex for this project reasonably reflects the efficient costs required to meet the capex criteria.[358] Our reasons for this decision are discussed in the strategic property capex section A.4.

[358] NER, cl. 6A.6.7(c)(1).